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SEVENTEENTH ANNUAL REPORT

OF THE

COMMISSIONER OF LABOR.

1902.

TRADE AND TECHNICAL EDUCATION.

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Erratum.

On page 570 the section beginning with "Classes of Institutions" and ending with "6. Trade courses" should be transposed to follow line 3 on page 571.

INTRODUCTION.

The Eighth Annual Report of the Commissioner of Labor, the report for the year 1892, presented the results of an investigation undertaken pursuant to an act of Congress directing "the investigation of, and report upon, the various industrial-school systems, and also technical-school systems, of the United States and foreign countries." The terms of the act were construed to include the systems of manual training, of apprenticeship, and of technical instruction in vogue in the several classes of special schools, as well as the public schools, at home and abroad. The object kept steadily in view throughout the inquiry was to compare foreign systems of industrial education with our own, and by this means to obtain from the older civilization of Europe some useful hints for the improvement of American schools, but above all the purpose was to ascertain the precise effects of manual and technical training upon local and national industries, upon the pupil, upon the quality of his work, his capacity for wage-earning, his value to his employer, etc.

In pursuance of this plan, the report gave for the United States and each principal European country, first, a general survey of the system of industrial schools with reference to their organization and administration and the relation of the various classes of schools to each other and to the industries of the country, and, second, a description of the leading individual schools, showing their aims, equipment, and management, courses and methods of instruction, and statistical details. Besides this material, which formed the bulk of the report, the results of special original investigations were given and discussed at some length in chapters on the kindergarten in relation to manual training, manual training in conjunction with book work, manual training and trade instruction in reformatories, and the effect of industrial education upon the individual.

In the ten years that have elapsed since this investigation and the publication of the report many changes have taken place in the schools for industrial education. The courses in the older schools

have been modified and developed along the lines determined by the experience of their earlier years, and new schools have been established with all the advantages gained from the experiments of the pioneer institutions and a study of the best foreign schools. The period of depression through which the industries of the country have recently passed has made the business interests keenly alive to the need of providing foreign outlets for surplus products, and the swift expansion of American industries and foreign trade has more than ever before brought American manufactures into competition with foreign goods and led to a desire to study the methods of foreign competitors. Special trade and technical schools have been judged both in this country and abroad as most efficient means for promoting the growth of industries and the improvement of the product. Manufacturers everywhere are turning to the subject of industrial education, no longer with any question as to its value, but merely as to the best means and methods. From manufacturers, from workmen, and from educators inquiries have come to this Department for fresh information in regard to trade and technical schools, for details in regard to the newer schools, for facts in regard to the present status of the old schools, for the methods employed in foreign schools, and for the results obtained. Thus it has seemed that both the progress of ten years and the strong interest of manufacturer and workman alike urged a fresh investigation and a report of the best and latest in the line of trade and technical education at home and abroad.

This report differs in several important particulars from that of ten years ago. In the earlier report industrial education was considered in the broadest sense. Considerable space was devoted to manual training, then just becoming firmly established in the public schools. The agricultural colleges and the institutes of technology were also included, as representing the earliest schools with an industrial tendency, although both classes are perhaps largely in the category with colleges and professional schools. In the present report, only industrial schools, properly so called, have been studied, and the classes of schools just mentioned have been omitted from any detailed treatment. Manual training seems to have made for itself a permanent place in the public-school work, not as a means of teaching trades or even the elements of any trade, but as an educative study in the same way as drawing, which preceded it in the public schools only a few years, or any bookwork of the school course. The schools of technology have

been entirely omitted. Their graduates, it is true, go into many industries, but the school training is specialized in purely scientific rather than in industrial lines. The agricultural colleges have developed, to a large extent, in the same direction as the technological schools, although all of them offer courses of college grade on agricultural lines. The rule was adhered to of considering no course of instruction which led to a degree. A somewhat recent development in connection with agricultural colleges—the dairy school—has been described at some length in this report. It represents one of the most notably successful efforts to benefit an industry by the application of scientific knowledge to its processes.

In the present investigation, as in the earlier one, it has been the purpose to present outlines of the systems in use in European countries and details of typical trade and technical schools of each class, showing especially such facts as the aim of the school, equipment as to grounds, buildings, laboratories and workshops, machinery and tools, etc., endowment, costs, method of management and maintenance, instructors, courses and methods of instruction, number of pupils, number of graduates, etc. Special inquiries, also, were directed to securing suggestions as to the improvement of the instruction in the schools investigated, and to ascertaining the influence of the schools upon the pupils, upon apprenticeship, and upon any industries, as well as the attitude of employers, of school graduates, and of labor unions toward industrial education.

Having indicated some of the schools which have been passed over in making this investigation, it will be necessary to indicate the classes of schools which have been considered as industrial, properly so called, and included in this report. It should be said, however, at the outset that usage in regard to such terms as manual training schools, trade schools, and technical schools is far from uniform. It will be the purpose here merely to indicate in a general way the characteristics of the several classes of schools.

In general, the schools included in this report are of three classes, namely, trade schools, technical schools, and schools of industrial drawing and design.

In the trade school in its simplest form the instruction is confined entirely or chiefly to the workshop, and consists in perfecting the pupil in the practice of the manipulations and operations of skilled workmen at particular trades. These schools differ according as the practice

work extends over a longer or shorter period and as more or less explanation and instruction in scientific principles are added to give a thorough understanding of the practice work. They are apprenticeship schools, and usually claim to graduate apprentices fully equipped except as to speed, it being generally considered that this is better acquired under ordinary working conditions in the trade.

The sole or primary aim of the trade school is to give the pupil a thorough practical knowledge of some handicraft. Incidentally much general information may be imparted in connection with the trade instruction, especially in drawing, mathematics, and scientific branches, but always in direct application to the work of the trade. Thus the trade school is clearly distinguished from the manual-training school where instruction is given in various kinds of tool work as an educational discipline. The difference may be illustrated by contrasting the course pursued in the New York Trade School, for example, with that in the St. Louis Manual-Training School and in the public manual-training high schools. In the one, the course is of short duration, and is limited to a severe drill in the theory and practice of a trade. The course in the others lasts three or four years, comprising high-school studies with manual practice in wood and iron work as a coordinate branch of education.

In some of the newer American trade schools, the Williamson School near Philadelphia and the two San Francisco trade schools, for instance, we have a new type of school. The practice in the operations of the trade has been extended over four years and the theoretical instruction covers substantially the same subjects as that in the manual-training high schools with special adaptation in the last half of the course to the particular trade which the pupil is learning. The aim of these schools is to give their graduates a much broader educational foundation to the trade than is possible in the short courses of the New York Trade School. The pupil is taught not only how to perform every operation expected of a skilled workman in the trade, but to understand thoroughly the scientific principles involved in each operation. Such training is expected to insure rapid advancement beyond the grade of journeyman.

Training in trade schools in the United States is intended to supply the place of the old-time apprenticeship, which has nearly disappeared under the conditions of present day industry. The trade-school graduates in many cases are able to begin work at the trade at

wages but slightly less than those of the practiced journeyman, and after a little experience receive full journeymen's wages.

The courses of instruction in most American trade schools have been arranged to train pupils in the shortest possible time to become wage-earners at the trade. This has been the result of the demands of both pupil and parent; the teachers and the employers are practically a unit in urging longer school preparation. In the foreign schools, on the other hand, longer and more detailed courses are the rule. This has been largely due to the restraining influence of the labor unions and their insistence upon the full period of apprenticeship. As the American schools grow in resources and pupils the tendency is to lengthen and improve the courses.

In the technical school in its simplest form the instruction is limited entirely or chiefly to the school room or the laboratory, and consists in only such use of tools and machines by the instructor as will clearly illustrate the application of the theoretical and scientific teaching to the particular trades. Many such schools make no provision for the use of tools or machines on the part of the pupil. Others introduce a good deal of such practice that the pupil may acquire a familiarity with all the processes of the trade. But the important distinction is that the school is supplementary to the work at the trade. The courses are arranged to provide theoretical and scientific instruction adapted for apprentices and workmen already at work at their trades. The purpose is to give the workman an understanding of the scientific principles involved in the work that he may be called upon to do at his trade and to increase his intelligence generally.

Most of the schools of this class are evening schools. Good examples of schools offering such instruction in this country are the school of Hoe & Co., the printing press manufacturers, Drexel and Spring Garden institutes, Rochester Athenæum, the Young Men's Christian Association schools, and the correspondence schools. In England this is the favorite type of instruction. Most of the instruction in the schools known there as polytechnics and technical schools is of this character. These English schools are officially regarded as wholly technical and as in no case taking the place of apprenticeship, the teaching of the practice of trades being expressly forbidden by the act under which they came into being and under which they derive their support. The technical instruction is very highly specialized and the shopwork is to explain the scientific instruction, to enable the pupil to learn how

to do—but carefully refrains from giving sufficient practice to enable the pupil to acquire dexterity or in any manner do away with the necessity of a regular apprenticeship in the trade. In fact in nearly all these English schools only those who are at work in the trade already are permitted to receive the benefits of the instruction. This has been a necessary concession to organized labor.

The influence of the English labor unions and the rigidity with which the would-be artisan is held in control will be appreciated when the length of apprenticeship—as much as seven years in some cases—is compared with the preparation demanded in this country and the elasticity of even this requirement. For while three or four years' apprenticeship is required here, it is not to be doubted that many attain to journeymen's full wages without ever undergoing any such exacting service. This is rendered much easier by the facility with which the workman can move from place to place. But the length of the apprenticeship is not all the difference. During the long period of the English workman's apprenticeship very low wages are received, while in the United States the apprentice from the beginning earns a living wage. The greater number of opportunities open to the bright, ambitious boy in this country is in large part the cause of this great difference.

In Germany also the private-shop apprenticeship with evening and Sunday instruction is favored. Education is compulsory up to the fourteenth year, but the great majority of the laboring classes begin work at this age. For the special purpose of continuing the instruction of the young workers after they are forced to enter the shops to earn a livelihood, the so-called continuation schools were created. They proved so well adapted to the needs of the workmen that they have been specialized for particular trades and have multiplied all over the Empire.

As the length of the period of instruction in the trade school increases the amount of theoretical instruction is added to more and more. In the continental countries in many cases trade schools of very high grade are known as technical schools; in these, while a craft is taught, the scientific principles upon which it is grounded are also exhaustively studied and exemplified in their applications to art and industry.

Such also are the American textile schools modeled on the older German textile schools. These schools, like those in Germany, represent a direct effort on the part of the textile interests to foster a local

industry by the education of the workmen in art and science as applicable to manufacture. They represent, too, the most important instances in this country where trade schools have received the assistance of the State and the municipality. These textile schools are all trade schools, but in their longer courses, extending over four years in the day school, the most thorough scientific and technical instruction is given.

In the schools of industrial drawing and design general instruction is given in freehand and mechanical drawing and in design applied to various industries. In the best of these courses a good deal of attention is given in the latter part of the course to the study of the processes of manufacture that the designer may understand the practical requirements of each particular product. Much practical good has already resulted from this kind of instruction, especially in cotton and woolen manufacturing.

Many of the American schools show the influence of European example, and the modifications and improvements have been notable. Manual training has long been in general use in European schools, but the manual-training high school is a distinct American type. The New York Trade School, too, has no European prototype, though the institution was established after careful study of foreign experience. No European school offers short trade courses of so distinctly practical a character. Doubtless the influence of the trade unions would be too strongly against courses so short. England has no trade schools in the sense of schools of apprenticeship. The so-called continuation school, so common in Germany for many years, represents a kind of instruction the need of which seems to be much felt just at present. The success of the Young Men's Christian Association classes and the rapid growth of the correspondence schools seem to be proof of this. Instruction of this character has been carried on by several notable schools for many years—for example, Spring Garden Institute of Philadelphia and the General Society of Mechanics and Tradesmen of New York.

The fact must not be overlooked that the mode of educational organization in European countries differs radically from that in the United States. In several continental countries, for example, a complete system of industrial education, from the kindergarten and manual training up through trade and technical schools to the higher

engineering and scientific institutions, is established by law and subsidized and administered by the State. With us, on the contrary, there is not only no such complete system, but there are, with the exception of a few recently established schools, no schools of an industrial character receiving governmental aid. Where public manual training schools have been established, the work has been done by municipal boards or by private enterprise. Hence there is no uniform system of manual training nor does any one of the manual training schools have any relation to any trade or technical school.

In spite of this there are several incorporated manual training schools in the United States, and a number of public manual training high schools of the same character, which surpass anything of the kind to be found abroad. In these something more is taught than the use of mere hand tools. Machine tools for wood and metal work abound, and the colossal mechanical appliances for testing the strength of materials, etc., seen in some of the schools, dwarf into insignificance the relatively meager equipment of the foreign schools of this class.

In respect to trade and technical schools of the best class, the conditions are, with a few exceptions, quite the reverse. The thoroughness of their courses is proverbial, and the specialization of their training comprehends the minutest details. The German *Fachschule*, where a single specialty is taught—upholstering, for example—turns out, at the end of the course, a thoroughly competent workman. The dyer who learns his art in the Crefeld laboratories is versed in all the subtile chemistry of colors; and from his knowledge of the composition of fabrics understands, to the fraction of a pfennig, the cost of dyeing a given number of yards blue or yellow.

A like thoroughness characterizes the instruction given in the horological schools at Besançon, Geneva, and Coventry—great centers of the watchmaking industry. It is a marked feature, also, of the trade schools of tailoring, dressmaking, and artificial flower making in France, Belgium, and Switzerland; of the Austrian wood-carving and cabinetmaking schools; of the German schools for locksmiths and horseshoers; and even of the fishing schools of the Scandinavian peninsula.

A few of the trade and technical schools of the United States take rank with their European prototypes. Of these, the New York Trade School, the Williamson and the San Francisco trade schools,

Drexel and Pratt institutes, the textile schools, and the New York Institute for Artist-Artisans are examples, and the number is yearly increasing. But the most of our schools of this class are inferior, in respect to the fullness and completeness of their teaching, to the foreign models. Of many, it is true, it may be said that the courses are as thorough and as long as the circumstances of the persons for whom they are arranged will permit. The schools must develop both supply and demand side by side.

In considering the subject of the present status of industrial education in the succeeding chapters, no attempt has been made to take a census of the various institutions in this and other countries in which trade and technical instruction in any form constitutes a feature. At the present time the number of institutions equipped for such training is of no great consequence. It is rather the organization and methods of representative schools that are something more than experiments that we wish to know. The chief object, therefore, has been to draw from original and other sources the facts which should most clearly show the actual progress that has been made in trade and technical schools, and their influence upon industry and the individual. Only those sources which are considered authentic have been used to supplement the original inquiries of the Department.

When this investigation relating to trade and technical schools was first taken up the intention was to publish the results in the bimonthly Bulletin of the Department; but as it progressed it was found that the information to be obtained would make a report altogether too bulky for the Bulletin, hence a larger number of experts were employed than was originally intended, and the results of the inquiry are, therefore, made the subject of an annual report.

In submitting this report, I wish to acknowledge the valuable services of Messrs. William F. Willoughby and Edward W. Bemis in connection with the collection and preparation of the data relating to foreign schools, and of Mr. G. W. W. Hanger, chief clerk, and Messrs. Chas. H. Verrill and G. A. Weber, all of whom have rendered most valuable aid in the preparation and editing of the material collected.

CARROLL D. WRIGHT,
Commissioner.

DEPARTMENT OF LABOR,
Washington, D. C., August 1, 1902.

CHAPTER I.

TRADE AND TECHNICAL EDUCATION IN THE UNITED STATES.

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CHAPTER I.

TRADE AND TECHNICAL EDUCATION IN THE UNITED STATES.

INTRODUCTION.

In looking for the beginnings of education of an industrial character in the United States, attention must be directed to the early efforts of the institutes of technology. These schools, to be sure, are primarily schools of science and engineering of collegiate grade, but their contribution to the extraordinary industrial progress of the past quarter of a century, both directly and through their influence upon scientific instruction in the colleges of the country, has been very large. Although the earliest of these schools, Rensselaer Polytechnic Institute, was established in 1824, the period of their real activity began immediately following the close of the civil war. The Massachusetts Institute of Technology opened its doors in 1865, and was followed in 1868 by the Worcester Polytechnic Institute, in 1866 by Lehigh University, and in 1871 by the Stevens Institute of Technology. Since then many other institutions of like character have been established, and the attendance of students pursuing scientific and engineering courses of this grade has grown to large proportions.

Scientific education received a decided impetus in the passage of the land-grant act of July 2, 1862. The colleges of agriculture and the mechanic arts in the several States, numbering about 60, founded from time to time under this act or complying with its terms, have received from the General Government under this act in the aggregate more than $16,000,000. These institutions have applied themselves to a great extent to the promotion of agricultural education. In several instances, however, the benefit of the grant has gone to institutions almost exclusively scientific or technological, while in many cases courses of such a character were established side by side with the agricultural courses. In most cases the industrial results of the work of these schools, except in the agricultural courses, have been, as in the institutes of technology, indirect rather than strictly industrial.

The agricultural tendency of these schools was given a fresh impetus by the act of March 2, 1887, by which the sum of $15,000 per annum went to each State for the establishment and maintenance of agricultural experiment stations connected with the colleges founded under

the land-grant act. Further governmental support was given the work of these schools by the act of August 30, 1890, under which $15,000 was voted to each State, this sum to be increased by $1,000 each year for ten years, after which the annual aid was fixed at $25,000. The act stipulated that this money should "be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life."

These institutions have in recent years greatly extended their work, not only in agricultural but in the South in industrial lines. The dairy courses established in Wisconsin, Minnesota, and Iowa, in 1891, and later in a number of other States have proved remarkably successful. Short winter courses in agriculture for the farmers have been a recent development, and the correspondence courses for farmers, a successful experiment initiated by the agricultural department of Cornell University, is the latest.

Some of the agricultural colleges now offer instruction professedly of an industrial character and not of a grade leading to a degree. In the colored Agricultural and Mechanical College, Greensboro, N. C., which will serve as the example for a number in the South, there are three departments: Department of agriculture and chemistry, department of mechanical engineering and architecture, and department of mechanics. In the department of mechanics the leading mechanical trades are taught in four-year courses. During the first two years of the course the time is largely devoted to shopwork at the chosen trade, supplemented by drawing, elementary mathematics, and science. In the last two years advanced work at the trade follows, with general shop training and instruction in advanced mathematics and science. Similar courses are offered in a number of the Southern institutions.

Another Southern institution, Clemson College, in South Carolina, added a textile department in 1898 and erected a building and equipped it with a full line of cotton-mill machinery for illustrating the manufacture of yarns and woven fabrics of all descriptions. Courses in carding, spinning, weaving, dyeing, designing, etc., are offered. A similar department was established in 1899 at the North Carolina College of Agriculture and Mechanical Arts, and in 1900 at the Mississippi Agricultural and Mechanical College.

A number of schools of art had long existed and some instruction in industrial drawing and design had been given in connection with the art courses.

No schools of an industrial character or even with instruction of an industrial tendency, other than the classes of schools already mentioned, were in existence up to 1870. That year was notable as marking the introduction of industrial drawing into the schools of

Massachusetts. The exhibit of the work in drawing of the Boston public schools and of the Massachusetts Normal Art School at the Centennial in 1876 attracted wide attention to the advantages of such training. The work of the pupils of the Russian schools in metal and of the Swiss schools in wood (sloid) at the same time drew the attention of educators to the educational possibilities of manual training.

The extension of drawing in the public schools has steadily gone on since that time so that it is now a generally required study in the larger towns and cities of the country. In 1890 the Massachusetts State Board of Education reported that industrial drawing was taught in the public schools in 201 out of the 351 cities and towns of the State. According to the law enacted in 1898 every Massachusetts town and city must give instruction in drawing in its public schools, and any town or city may, and every town and city of 10,000 or more inhabitants must, maintain evening schools for the instruction of persons over 14 years of age in industrial drawing, both freehand and mechanical (among other studies).

Manual training followed close upon drawing in its extension in the public schools. As early as 1870 instruction in sewing was obligatory in every public girls' school in Boston. Manual training in the form of typesetting was offered to the boys and girls of the Jamestown, N. Y., public schools in 1874 as an experiment. The Centennial exhibits of foreign work, as has been said, attracted marked attention to the possibilities of manual training, and sporadic experiments followed in a number of cities. Progress at first was slow. Difficulties were experienced in raising funds, securing equipment, providing places for instruction, etc.; but the work went steadily forward. Wherever the experiment was tried the training soon became a part of the public-school instruction. In 1890, according to the Report of the Commissioner of Education for 1899–1900, manual training was offered in the public schools in 37 cities and towns of 8,000 population or over. In 1894 this number had increased to 95; in 1896 the number was 121, and in 1900 the total number was 169. Massachusetts now requires that "every town and city of 20,000 or more inhabitants shall maintain as part of both its elementary and its high-school system the teaching of manual training."

The character and extent of the manual training offered in the public schools of the country are diverse. In many places only the simple exercises in drawing, woodworking, and sewing are introduced as electives in the grammar grades. In other schools one or all of these exercises are required of all the pupils; in other places much more complex courses have gradually been worked out; while in other places still, in the larger cities, the manual-training high school has been added, where alongside the literature, mathematics, and science of the ordinary high-school course four years' manual practice is given

in drawing, carpentry, wood turning, pattern making, cabinetwork, foundry work, forging, machine-shop work, etc. The public schools can not, as a rule, carry manual training much beyond the elementary exercises of drawing, woodworking, sewing, and cooking in the grammar grades. The expense of equipment and cost of maintenance forbid the further extension of the instruction, at least outside the larger cities.

At the same time with the movement for industrial drawing and manual training in the public schools in Massachusetts arose a desire for more adequate provision for training in industrial design. The Lowell School of Practical Design, as a result, was established in 1872 for instruction in textile design. In Philadelphia the School of Industrial Art followed in 1877; in Providence the Rhode Island School of Design in 1878, and within more recent years a large number of others.

An outgrowth of the Philadelphia school, and associated with it as a department, is the Textile School. This school was opened in 1883, and was one of the earliest American trade schools, and is still one of the best. It is notable as the earliest attempt to promote the interests of a manufacturing industry by means of industrial teaching, whether by State or individual support. The school was established and equipped by the manufacturers of Philadelphia, but the State of Pennsylvania has contributed liberally toward its support. So successful has been the work of the school that similar schools have recently been opened at Lowell, New Bedford, and Fall River, Mass., Atlanta, Ga., Raleigh, N. C., Clemson College, S. C., and in Mississippi.

In trade education for the building and mechanical trades the New York Trade School was the pioneer, in 1881. Since then many schools have adopted its methods in a few courses in conjunction with their other work, but it still stands as the only school of its kind. The Williamson Free School of Mechanical Trades, opened in 1891 near Philadelphia, represents different methods—a four years' course of theoretical and scientific instruction in connection with four years' manual work in the school shops. San Francisco has two schools of the same type—one for the building trades and one for the mechanical trades. The success of all these schools has been marked from the first.

In the South industrial training for the colored race has taken a special development. The slender resources of the schools and pupils, the ignorance of the people, and the needs of a country undeveloped industrially, altogether presented a peculiar problem. Hampton Institute, the pioneer school of the class, opened in 1868, attempted to solve the problem by teaching trades to the colored pupils. The pupils are allowed to pay a portion of the expenses of their schooling by working in the school shop and on the farm. The result has been from the first remarkably successful. A large number of schools

employing the same methods have been established all over the South. The most notable of these is the school at Tuskegee, Ala., which has over 1,000 pupils.

Among the oldest schools giving instruction for the benefit either of industry or the workmen are those schools where drawing, mathematics, physics, etc., are taught to workmen in evening classes. In this country they have frequently been referred to as technical schools, and sometimes as continuation schools, from their likeness to the German continuation schools. Although one of the oldest types, the appreciation of the need of such instruction on the part of workman and employer has within a few years given education of this class new life. Spring Garden Institute, Philadelphia, and the School of the General Society of Mechanics and Tradesmen, New York, the School of Hoe & Co., and the Newark Technical School are examples of the older schools. Drexel Institute and the Rochester Athenæum are notable examples of recent progress on these lines. In this connection (for their aim is to give instruction of the same character to pupils of the same class) should be mentioned the industrial evening classes of the Young Men's Christian Association and the correspondence school classes. In the former about 6,000 pupils are in attendance and in the latter schools an enrollment of more than 300,000 pupils is claimed.

As will be seen from what has been said, no complete system of industrial schools exists either in the United States or in any State. The progress has been made in the way of independent growth, for no coordination exists between the different classes of schools. Manual training has for the most part grown up in the public schools, but even where it has had the encouragement of State law, as in Massachusetts, or of State aid, as in New Jersey, each local board has controlled the direction and method of growth. The same is true of drawing, the basis of all industrial training. Trade, technical, and technological schools have been almost entirely the result of private initiative and support. The exceptions relate to textile trade schools which have had State and municipal aid and to those technological schools that are departments of State universities or of agricultural and mechanical colleges. The agricultural and mechanical colleges have all had the aid of the Federal Government to a generous extent. Many, too, in their positions as State institutions have had the financial support of the State governments. But each institution is independent of any other as to courses and methods of instruction and as to all matters of administration. The only coordination is such as has resulted from the influence of successful example and of voluntary cooperation.

With such a history and with such lack of any complete uniform system of industrial schools the difficulty of any exact classification of

schools will be readily understood. Any classification that might be made would be arbitrary and open to criticism. The classification that has been adopted had for its aim the bringing together of schools of the same general purposes and character. It was thought that a clearer idea could thus be gained of what has been accomplished along the different lines followed by the various schools. As presented in this chapter, a description of typical individual schools is given, arranged in the following classes:

Trade schools, including schools for teaching building and mechanical trades, barbering, brewing, dairying, domestic science, dressmaking, tailoring, and millinery, textile manufacture, watchmaking, and several miscellaneous trades; technical and continuation schools; Young Men's Christian Association industrial classes; correspondence schools; schools of industrial drawing and design; industrial schools in the South for the colored race, and industrial schools in the South for the whites.

As already explained, only trade schools, technical schools, and schools of industrial drawing and design as above enumerated are here described. This excludes from consideration the several important classes of manual training schools, agricultural colleges (except such as have trade courses) and institutes of technology, and all courses of instruction leading to a degree.

BUILDING AND MECHANICAL TRADE SCHOOLS.

In this country schools for the teaching of the building trades and other mechanical trades are those usually meant when trade schools are spoken of, and the New York Trade School is the best known school of the type. In this school the various building trades are chiefly taught, although classes in blacksmithing and printing have been under training. The method used employs not only manual practice but instruction in the scientific principles on which such practice is based. In the day classes four consecutive months are required to complete the course. For evening classes a much longer time is necessary. Schools of this class vary considerably in their scope and methods, as will be seen on an examination of their courses of study.

Another type of schools of this class is represented by the Williamson Free School of Mechanical Trades. In this school the course goes beyond the principles of the trade operations, and is designed to give such academic instruction as will lay a good foundation in the physical sciences, mathematics, and mechanical drawing. This corresponds to a large extent with the academic part of the course in the manual-training high schools. The aim in the shorter trade courses is to train the pupil to make a good journeyman at the trade; in the other not only to prepare for the trade, but to lay such a broad foundation as will assure future promotion above the grade of journeyman. Two

other schools which represent the most advanced experience in this direction are the California School of Mechanical Arts and the Wilmerding School of Industrial Arts, both at San Francisco.

Nearly all the industrial schools scattered throughout the South give instruction in these trades. Their work is fully described in another part of this report, where the schools are grouped by themselves.

In connection with this class of schools attention should be called to the apprenticeship system in use in the machine shops of the Baldwin Locomotive Works and the Brown & Sharpe Company, referred to elsewhere (see pp. 382 to 388). In both these shops the apprentices are required, in addition to their shopwork, to take up a course of technical studies in evening schools. The shopwork of these apprentices, unlike that in the schools, is paid productive work, differing from other productive work in the same shops only in that the apprentices are in charge of a special instructor, and that they are retained at each operation only long enough to thoroughly learn it. In either establishment the number of apprentices is sufficiently large to bear comparison with the largest of the trade schools, and in the Baldwin Works more than a thousand apprentices are receiving the benefits of the training.

NEW YORK TRADE SCHOOL, NEW YORK, N. Y.

This school is undoubtedly the largest and most thoroughly equipped exclusively trade school in the country. The following regarding its purpose and system of instruction is for the most part taken from the catalogue of the school:

The New York Trade School was founded in 1881 by the late Col. Richard T. Auchmuty. The purpose of the school is to provide instruction for young men in certain trades, and to afford young men already in those trades the opportunity to acquire additional skill and knowledge. Owing to its decadence, the apprenticeship system no longer affords young men wishing to learn a trade that careful, systematic, and thorough training which they should receive if they are to be mechanics of the highest skill. Colonel Auchmuty clearly saw the serious need this problem presented, and to his philanthropy and personal effort is due the establishment of the New York Trade School. While a charge is made for admission, the terms of tuition are merely nominal and meet but a small part of the cost of maintaining the school. A liberal endowment, which the school possesses, enables the institution to carry out the object for which it was founded.

The system of instruction followed at the school is what is known as the "Auchmuty system," and was originated by the founder. By this system a course is arranged in which both the practical and theoretical branches of the trade are taught, so that not only is skill quickly acquired, but the scientific principles that underlie the work are also

studied. This system differs from anything heretofore attempted in trade instruction. It has produced remarkable results and has attracted much attention in this country and in Europe. As a result of the development of the various courses to their present efficiency, it can safely be said that the purpose for which the system followed at the New York Trade School was devised has been accomplished, namely, to enable young men to learn the science and practice of certain trades thoroughly, expeditiously, and economically, leaving speed of execution and experience to be acquired at real work after leaving the school. For each trade taught at the school a course of instruction has been prepared. These courses outline the work which the student is required to go through. At first the student is put on work that is simple, but as skill and a workmanlike use of the tools are acquired he is advanced to work that is more difficult and complicated until he is made familiar with the various branches of his trade. The work given the student is of a thoroughly practical character, such as will be met with in actual practice at the trade.

The scientific instruction imparts knowledge of the trade that is of the highest value, and is given by means of carefully prepared lectures, manuals, diagrams, and experiments.

Mechanics of skill and long experience act as instructors, and each student receives individual care and attention. Careful explanation is made of every step in the course. The instructors are constantly with the students, and each member of the class is shown how to handle his tools and how each piece of work should be done.

The school is located on First avenue, Sixty-seventh and Sixty-eighth streets, and covers a plot of ground measuring 200 feet on the avenue, 325 feet on Sixty-seventh street, and 113 feet on Sixty-eighth street. The main entrance is on First avenue. The buildings are built of brick and are one story in height, except those erected in 1892 and 1896. These later additions are three stories high. The various workshops and lecture rooms are spacious, well lighted and ventilated, and are heated by steam. The library contains a collection of the best class of literature, and these books the members of the school are privileged to take home. Trade and technical papers are also kept on file for the use of the students.

The equipment of the respective workshops of the school affords every facility for instruction. Each student is provided with all necessary tools and material and is given ample bench room.

The evening classes are intended to afford young men already in the trades an opportunity to improve themselves, and to give young men who are earning their living at other occupations during the day a chance to learn a trade. The hours of attendance of the evening classes are from 7 to 9.30 o'clock, and enable those who are regular in attendance to learn in a term more than can be acquired in a shop in

many years. On school nights the reading room is opened at 6 o'clock, and young men who choose may occupy this room until the hour when class work begins.

The day classes, which are also open to beginners as well as to those who have some knowledge of the trade, graduate young men who are possessed of the skill of the average journeyman and have a wider knowledge of the trade in all its branches. In the past few years much work of an advanced character has been introduced in the various day courses, and the constant practice gained by continuous application, such as the hours of the day classes afford, enables a pupil to rapidly acquire both skill and proficiency. The hours of attendance of the day classes are from 8:30 a. m. to 4 p. m., excepting on Saturday, when the school closes at noon.

The charges for tuition in the day classes range from $25 per term for the course in sign painting to $35 for the course in carpentry and $40 each for the courses in bricklaying, cornice work, electrical work, house painting, plumbing, and steam and hot-water fitting. In the evening classes the charges are as follows: Drawing, $6 per term; blacksmithing, cornice work, fresco and sign painting, $12 each; plumbing, printing, and steam and hot-water fitting, $14 each; bricklaying, carpentry, electrical work, house painting, and plastering, $16 each.

At the termination of the course of instruction a careful examination is held of both the day and evening classes. To those who attain the required standard in workmanship, theoretical knowledge, and general proficiency a certificate is given. To those who have not advanced sufficiently in manual work, but otherwise pass a satisfactory examination, a testimonial of merit is issued. Owing to the limited amount of time in an evening course, it is not always possible for a student of an evening class to get far enough in the manual course to obtain a certificate the first year; but many evening students return to continue their studies and by completing the course of instruction obtain a certificate. The testimonial of merit entitles the recipient, should he not complete the school course, to apply for reexamination at the school within three years, and if in the meantime by working at the trade the necessary proficiency has been acquired a certificate will be issued.

Students who obtain a certificate or a testimonial of merit are given the privilege of entering the following year at half the regular tuition, provided the same course is taken. This reduction is allowed only in the evening courses.

The school year opens the middle of October and closes the middle of April. The day classes meet six days in the week. The sessions of the evening classes in drawing are held two nights each week, and in the house and fresco painting classes four nights. All the other

evening classes meet three nights each week. The age limits governing admission to the several classes are as follows: In electrical work, pattern making, plumbing, printing, and the night class in bricklaying applicants must be between 17 and 22 years of age; in carpentry, house, fresco, and sign painting, and in the day class in bricklaying they must be between 17 and 24 years of age; and in drawing, blacksmithing, steam and hot water fitting, plastering, and cornice making they must be between 17 and 25 years of age.

In the course in steam and hot water fitting an attendance of three consecutive months in the day school, or two consecutive terms of six months each in the night school is necessary to qualify for a certificate. In the other branches the pupils in the day schools are required to complete four consecutive months, and those in the night school three terms of six months each.

The school also conducts a course of lectures for electrical workmen and a course for steam engineers. Each course consists of ten lectures. By these lectures it is intended to provide information that will be of value to the journeyman in his practical work.

In connection with the school there is a students' dormitory where young men who come from distant points may obtain accommodations. This building is within five minutes' walk of the school, and contains pleasant, well-furnished rooms which are arranged for one, two, or three occupants. Each student has his own bed. The rate for lodgings is $6 per month. Meals can be had in nearby restaurants and boarding houses at from $3 to $3.50 per week.

The evening classes consist very largely of students who reside in Greater New York and nearby cities. In the day classes forty different States, the Dominion of Canada, Mexico, and Central America are represented. The only requirements for admission are that the applicant be respectable in appearance and capable of reading and writing.

The courses of instruction are as follows:

Drawing: This course offers, by means of evening classes, instruction suitable to those in the plumbing, bricklaying, carpentry, and steam fitting trades. The course does not aim to make expert draftsmen. The idea will be to give instruction that will enable young men in the trades mentioned to read and understand plans and drawings that are met with in daily work. No certificate is awarded for drawing, and no examination will be held at the end of the term, as in the other departments of the school.

House painting: Instruction is furnished in both day and evening classes. The painting department is under the supervision of a trade school committee appointed by the Master Painters' and Decorators' Association of New York.

In house painting, the manual instruction is as follows: Care of brushes and pots; glazing; treatment of new wood, including killing knots, priming, puttying, and sandpapering, second and third coats; burning off paint; painting brickwork, woodwork, and plaster walls; lining; mixing white paint, materials required for same; names of the ordinary colors and stainers and their use; mixing oil colors; mixing calcimine colors; painting in three shades; flatting; stippling; calcimining, including preparation of size, sizing, and preparation of calcimine; staining; varnishing;

treatment of hard wood; polish white; gilding, bronzing, graining, and marbling. Particular attention is devoted to practice in mixing both oil and calcimine colors. In mixing the paints, colors of various shades are given, which the pupil is required to match.

The scientific instruction in house painting treats of the following subjects: General painting, preparation of surfaces, colors, materials, enameling, treatment of hardwood, staining, graining, varnishing, treatment of plastered surfaces for paint and calcimine, gilding, bronzing, and frescoing.

In the evening department, the instruction during the first term is arranged so that the student will acquire a thorough training in the groundwork of painting that he may become a good brush hand. The instruction comprises plain painting on wood, brick, and plastered surfaces, doors, windows, etc.; burning off paint; mixing and matching of oil and calcimine colors, calcimining, the preparation of calcimine and size, preparing plastered surfaces; cutting out cracks, etc.

The advanced branches enumerated in the course occupy the second and third terms, except graining and marbling, which is taught only during the third term.

In addition to the course outlined, the day class receives instruction in paper hanging and elementary fresco painting. The fresco painting is of the kind that a house painter is frequently called upon to do, especially in the small towns.

Fresco painting: Instruction in this department is given only to evening classes. The instruction consists in preparing walls and ceilings for calcimine; treatment of cracks and stains; preparation of size and how to mix calcimine; lining; how to make and cut stencils; laying in panels; how to make pounces; how to lay on a flat ornament; how to shade from the flat; how to shade an ornament; moldings and how to shade them; tinting; wall and ceiling work.

In the fresco class, the work is done on plastered walls and ceilings, and on canvas screens. The walls are arranged in alcove fashion, and measure six feet by nine, affording an excellent area for painting. The fresco department, in addition to being one of the oldest in the school, is also, by reason of the beautiful work that is done from season to season, one of the most attractive. Many excellent specimens of decorative painting are on exhibition at the school. As an aid to the work in colors, instruction in drawing is also given. This drawing is of a character that is particularly valuable to one studying fresco painting, and greatly assists the student in grasping the principles of light and shade, as well as tending to give the training necessary to develop accuracy of the eye and hand. The drawing is done from plates and casts.

The instruction in drawing is given one evening in the week, the other evenings the class meets being devoted to painting. Only those who can take both drawing and painting are admitted to the class.

Sign painting: Day and evening classes receive instruction. The manual instruction is as follows: The proper way of making boards for signs, and the method of preparing them for lettering; treatment of old signs for the purpose of relettering; styles of letters and spacing; lettering, one color; lettering, two or more colors; shading, blocking, and lining; smalting; gilding on wood and on glass; lettering on japanned plates; lettering on muslin; lettering on wire.

The scientific instruction consists of lectures on the colors principally used, and how they should be mixed to meet the requirements of different kinds of work; what colors should be used in shading and blocking to produce the effect desired. Style, proportions, and spacing of letters. Laying out work. Preparation of size; application of size and leaf, and the difference in the treatment of gilding on wood and on glass. Use of japans and driers, smalting, and such other subjects of a technical character as can only be acquired in a workshop in many years.

In the evening department, the work begins with plain lettering in the first term, and leads up to gilding on wood and glass in the third term.

After understanding how to prepare a new as well as an old signboard for work, the pupil is practiced in forming the letters of the alphabet in roman, block, and Egyptian styles, so as to impress on the mind the shape and proportion of each letter. Then, with palette and pencil, signs are painted from designs furnished by the instructor. In a short time the pupil understands not only how to letter, but can also lay out his work. The work given pupils is of the same character and variety as done in a shop, even to laying out and painting large signs requiring the use of a ladder to work from.

Blacksmiths' work: This course is given to evening classes and embraces general blacksmithing, tool making, railing, and ornamental work. In forging, the instruction is in the management of the fires, in drawing down, bending, shortening, welding, splitting, punching, chamfering, riveting, railing, and housework. In vise work the instruction is in filing to line, fitting tongues and grooves, chipping, bevels, scraping, ring work, drilling, etc. In tool making the instruction includes machine, lathe, millers', stonecutters', carpenters', plumbers', pipe and steam fitters', tin and copper smiths' tools; also in the principle of tempering.

The student is advanced as rapidly as his proficiency will permit. At the outset of the course simple work is done, and as the student acquires skill he is advanced to work of a more intricate character. The shop has a modern equipment, comprising a blast and exhaust system and standard forges.

Steam and hot-water fitting: Both day and evening classes receive the instruction given in this course. The fitting department is under the supervision of a trade-school committee appointed by the Master Steam and Hot-Water Fitters' Association of New York.

In the practical part of the course the students in both the evening and day classes are taught how to set and connect different kinds of radiators and how to make the various kinds of coils in common use, such as return coils, miter coils, corner coils, etc. These coils are constructed in various sizes, three-quarter to 2-inch pipe being used. Then follows instruction in piping of dwellings and buildings, and the various systems of heating, such as steam one-pipe, steam two-pipe, hot-water, direct-indirect, and high and low pressure, each being erected in turn. The students are given a set of plans and on these plans are drawn the actual heating plan that would be required for a building of the kind represented. The measurement of each piece of pipe is taken from the plan, and the fittings, valves, and other fixtures required to make a complete job are used in the construction of the work. In the workshop there is an arrangement of girders and beams to which the work is suspended, the pipes being run with a proper pitch, the same as would be demanded in actual practice. On the completion of each job, connection is made with one of the steam lines of the school and the work which has been erected receives a thorough test.

The scientific instruction consists of lectures on the principles of steam and hot-water heating. The lectures include the following subjects: Tools, fittings, and pipe; general heating; low-pressure steam; indirect steam heating; single-pipe low-pressure steam; hot-water heating; high-pressure steam heating; steam-power plant; exhaust-steam heating; power fan or blower system of steam heating and ventilating.

During the first term in the evening department the instruction includes steam one and two pipe, and hot-water systems, with lectures thereon. The second term embraces the balance of the course in practical work as well as lectures.

The evening course in drawing affords the members of the evening department in fitting the opportunity of studying plan work should this instruction be desired. In the day class the drawing of plans is included in the course.

Bricklaying: Day and evening classes receive instruction in this line of work. The manual instruction in bricklaying includes the building of 8, 12, 16, and 20 inch straight walls; return corners and intersecting walls; piers, arches, fireplaces, and flues; setting window frames, sills, and lintels; blocking, toothing, and corbeling.

Fireproof brickwork and the manner of laying solid, hollow, and annular slabs and how fitted into beams, walls, floors, and arches is also included in the course.

The scientific instruction is upon the properties of mortar and cement and how they should be mixed; arches, their various styles and the advantages of each; flues, their construction and utility; foundations, walls, bonding, etc.

In the bricklaying classes the young men are taught first how to handle the trowel and how to spread mortar. After this they are practiced on 8 and 12 inch straight walls. When these can be carried up plumb and the courses of brick laid level, the class builds, successively, walls returned at right angles, piers, arches, fireplaces, and flues, etc. In all work great care is exercised that each brick is properly laid and that the joints are neatly pointed. The brick work is carried up as high as the young men can conveniently work; it is then torn down and the bricks cleaned, to be used again. Before an exercise is commenced the instructors show how it should be done. The young men are then required to practice under the constant supervision of the instructors, until they can do the work well.

In the evening department the first term is devoted to straight walls, blocking and toothing, piers, return corners, and intersecting walls. The second term comprises arches, fireplaces, flues, setting and building around window frames, and other advanced work. In the third term fireproof work is taught. Should the evening student desire to obtain instruction in plan work, the regular evening drawing class gives him this opportunity.

Besides the above, the students of the day class have the privilege of attending the evening class in plastering, without additional charge. Drawing of plans is a part of the day course.

Plastering: Evening class instruction is given in this course, which includes lathing, scratch and brown coat work, hard finishing, and cornicing. The course in plastering is arranged for beginners as well as those who are working at the trade. The work of the first term includes the putting on of the various coats, and simple cornicing. The second term continues this work, but more elaborate cornicing is done. The third term completes the course in cornice work.

The plastering room is divided into compartments measuring 8 by 10 feet and 9 feet high, the walls and ceilings being lathed in the usual manner. The students are taught how to apply the scratch coat on walls and ceilings. This coat is taken off by laborers after each evening's work, leaving the laths ready for the young men to replaster on the following evening. The class is exercised on this work until it can be done neatly and rapidly. The scratch coat is then allowed to harden, and the young men apply the brown-coat work, and finally hard finishing and cornice work is done.

Cornice and skylight work: Day and evening classes are given instruction in this course as follows:

Part I. Cutting curves and circles, showing the use of the shears; filing and tinning the soldering copper; soldering flat seams; soldering upright seams; forming simple moldings; problems in practical geometry; drawing simple details from scale drawings.

Part II. Drawing details, obtaining patterns from same, and setting together the following work: A molded gutter with flat and return head; a square molded leader head; an octagon molded leader head; a plain window cap; an ornamental window cap; raised panel work; a plain cornice with modillions; an ornamental cornice with brackets; square turrets; finials; crosses; pediments; dormers; ventilators; flat skylights; hip skylights; bay windows; special problems.

Part III. Hammer work. This section comprises the drawing of details, obtaining patterns from same, and constructing the following, viz: In hand work—Making a 6-inch full ball in six gore sections; making a 6-inch full ball in six horizontal sections; round finial; center piece for a ceiling. In machine work—Circular panel in

two pieces, using machine profiles; circular molding in two pieces, using machine profiles; segmental pediments with columns.

Students are advanced as rapidly as their proficiency will permit. When a student shows that he understands an exercise and can get out the pattern readily, he is advanced to the next problem. By this course it is intended to provide for young men in the roofing and cornice trade an opportunity to advance themselves in the work of cornice making.

Carpentry: This department provides a very thorough and practical course in house carpentry and framing for young men, and includes also the drawing of plans. Instruction is given to day classes.

The course at the beginning embraces a variety of bench work which brings into use all the tools commonly used in the trade. It is necessary that the student first obtain a knowledge of how to properly use his tools and how to care for the same. Great care is taken that each student acquires a workmanlike and skillful use of the various tools, and that he understands how to keep them in fit condition for work. Continuing in the course, the student is taught how to lay out and construct centers and window frames; make, case, and hang doors; lay beams and set bridging in same; erect stud partitions and lay flooring. A complete course in joinery work is also given. In addition to the work outlined, the course includes house construction and framing. Although the lack of space prevents the erection of a frame house of full dimensions, the same attention is devoted to all the details of construction as would be required in similar work on a larger scale. In work of this kind the pupils obtain a knowledge of the erection of framing for a house; also of sheathing and shingling. The window frames, sashes, doors, etc., are all made and set in position by the young men. Lectures imparting the scientific features of the trade are also given during the progress of the course.

This course of instruction gives each member of the class a varied amount of work, and is arranged for those desiring to enter the trade as well as those who are working in shops.

Pattern making: Evening class instruction is given in this course. In practical work the course embraces the following divisions:

1. A series of exercises that brings into use the various bench tools used in pattern making. The student is taught what the different tools are for, and how to use and keep them in order. The exercises afford varied practice with the tools, so that the student acquires manual dexterity.

2. A complete course in joinery, making the student familiar with this important feature of pattern making.

3. Wood turning. Under this section the student is taught all about the lathe, its parts, how to regulate and control, what the wood-turning tools are, the purpose and use of each. Suitable exercises give necessary practice to enable the student to become familiar in working at the lathe and using the tools.

4. The following work in the line of pattern making is included in the full course, namely: Cylinders, pipe elbows and tees, core boxes, cone pulleys, propeller wheels, fly wheels, parts of a lathe, various parts of machinery, and other practical work.

Drawing is taught in conjunction with the practical work. The students prepare and make drawings of patterns, and work from same. This instruction enables them to readily read plans and drawings such as come before the pattern maker.

The scientific instruction includes the following subjects, namely: Woods and their grain, the kind best adapted for pattern making, drying, and seasoning; metals, their weight and shrinkage; shrinkage of patterns and castings; wood bending; making cores, and the materials required; shellac varnish and why used.

Printing: Instruction in this course is given to an evening class, and consists of all kinds of mercantile printing, such as billheads, note heads, statements, letter heads, business cards, dodgers, circulars, blank forms, tabular work, cutting and mitering

rules; also making ready for press and presswork. In work of this character it is not a matter of typesetting alone. The general principles that apply to good display are carefully explained in each piece of work undertaken by the student. The printing office of the school contains an equipment in the way of type, presses, and machinery that affords every facility for instructive purposes, and every detail of job composition is taught.

Electrical work: Both day and evening classes receive instruction in electrical work. The different divisions included in the course are bellwork, burglar-alarm systems, electric gas lighting, and electric wiring.

In bell work the student is first taught how to make, solder, and tape joints; tack up wires, and install wire on cleats and insulators. Then follows a series of exercises in practical bell work, in which the various problems a bellman should understand are illustrated. The exercises provided for in this section of the course teach the student the principles of making connections for bells, push buttons, switches, strap keys, buzzers, floor attachments, annunciators, letter boxes, door attachments, and batteries.

In that part of the course devoted to burglar-alarm systems the student acquires a knowledge of how to wire for, and to make connections with, window, door, and transom springs, and the arrangement of alarm bells.

In electric gas lighting the work includes making connections for automatic gas-burners, automatic push buttons, spark coils, induction coils, multiple and ratchet burners.

On the completion of the foregoing courses electric wiring is then taken up. This section embraces wiring on cleats and insulators, also molding and tube work. Everything pertaining to work of this character is taught, and all fixtures and attachments commonly used in electric wiring are utilized in the erection and running of wires.

In the evening department lectures relating to work that the student is on at the time are given at intervals during each of the three terms. Drawing is a part of the work of the third term. For the day students drawing of plans is included in the course.

Plumbing. Instruction in this course is given to both day and evening classes. The plumbing department is under the supervision of a trade school committee appointed by the Master Plumbers' Association of New York.

In practical work the course is as follows: Seams; overcast joint; cup joint; running and calking soil pipe; wiping $\frac{5}{8}$-inch horizontal round, horizontal branch, and upright round joints; making quarter bend; wiping $\frac{5}{8}$-inch upright branch; stop cock; floor flange; 2-inch ferrule; bath plug; vertical branch; wall flange; making half S and S traps; wiping large and small soldering nipples; 4-inch upright and horizontal ferrules; upright and horizontal tank seams; $\frac{1}{2}$-inch horizontal round, horizontal branch; upright round and vertical branch joints; $\frac{5}{8}$-inch oblique round and overhead round joints; plain bib vertical branch; 2-inch horizontal round; upright round; upright branch and vertical branch joints; 2-inch short bend with ferrule; 4-inch short bend with ferrule; setting up sinks, basins, boilers, wash trays, closets, bath tubs, and miscellaneous work.

The scientific instruction includes the following subjects: Drain, soil, and waste pipes; trapping and ventilation of drain, soil, and waste pipes; supply pipes; boilers; tanks; fixtures; trapping of fixtures; pumps; disposal of sewage in country houses; water supply for country houses; miscellaneous; correcting diagrams of improper plumbing. In the day class the drawing of plans is included in the course.

In the evening department the series of lectures is given during the student's first term, which allows two nights each week for practical work and one night for lecture. During the succeeding terms three evenings each week are devoted to

practical work. Should a member of the evening class desire to study drawing, the regular evening drawing class offers an opportunity of obtaining a knowledge of building and plumbing plans.

The work benches are equipped with furnaces and pots of special make, which allows the solder to be heated by gas. Ventilating fans keep the air in the shop pure and wholesome. Each student is advanced as rapidly as his proficiency allows. When a student shows he can do a piece of work properly he is advanced to the succeeding exercise, and as each piece of work is completed it is approved and marked by the instructor and put away in the student's locker until the end of the term.

A series of lectures treating on the science of the trade has been arranged with great detail and thoroughness. For each of the subjects printed forms are furnished, containing questions, with blanks left for the answers. The lecturer reads a question and writes the answer to it on the blackboard. This answer is copied by the young men in the blank space in the printed forms. The lecturer then proceeds to explain fully what is meant, to illustrate his meaning by diagrams, and to answer questions put by members of the class. The printed forms, after being filled up, are kept by the young men for future reference. Diagrams are also given the members of the class, of improperly arranged plumbing, to correct. Many of these diagrams of improper plumbing are reproductions of actual work that has been erected by incompetent workmen.

By this course of manual and theoretical instruction a knowledge of plumbing is acquired which could not be obtained in any other way.

The school is under the general management of a board of trustees. There are 28 instructors, all of whom are practical mechanics, and a few are trade-school graduates also. The number of pupils in each class during the last session was as follows:

Day classes.		*Evening classes.*	
Plumbing	118	Plumbing	166
Carpentry	22	Carpentry	21
Electrical work	38	Electrical work	54
Bricklaying	17	Bricklaying	32
Sign painting	3	Plastering	9
House and fresco painting	8	Blacksmiths' work	19
Sheet metal and cornice work	4	Sheet-metal and cornice work	38
Steam and hot-water fitting	13	Steam and hot-water fitting	19
		House painting	12
		Fresco painting	31
		Sign painting	17
		Printing	16
		Drawing	14
Total	223	Total	448

Since the school was established 8,674 pupils have been enrolled in the different classes, and of this number 2,900 have received certificates of proficiency.

The land, buildings, and equipment, which to the present time have cost $300,000, were provided by the founder, Col. Richard T. Auchmuty. The school is supported by tuition fees and an income from an endowment fund provided by the founder. The cost of maintenance during the year 1899–1900 was $33,000.

According to a statement furnished by the officials in charge of the school the present courses of training and study are considered adequate. The aim being always to maintain a high standard of proficiency in this respect, new features are introduced and made use of whenever changes in the different trades require it. The building-trades industry in Greater New York and vicinity has derived inestimable benefit from the work of this school. The young men who have completed the various courses and gone out into the trades as helpers and apprentices have a thorough understanding of the principles which govern their work, and consequently they make better progress. In the end they are more valuable to their employers than mechanics who have not had a trade-school training. The day classes being composed of pupils from distant States, the influence and benefits derived from their training are bound to be far-reaching.

It is claimed, also, that the school has helped to raise the standard of intelligence and efficiency among the working classes generally, and has tended to promote industrial, educational, and social development. There has been some opposition from labor unions, on the ground that trade schools generally create an oversupply of labor. It is claimed that this contention is wrong and can not be supported by facts. The school aims to give its pupils such preliminary knowledge and training as is necessary to enable them to become first-class workmen, and the master mechanics and builders state that the number of first-class mechanics never equals the demand.

So far as the graduates are concerned, because of their careful training in the school they are preferred by employers over merely shop-trained apprentices and workmen. After having had a reasonable amount of practical experience in the trades they have no difficulty in obtaining steady employment, in some instances at higher wages than the ordinary mechanics. As regards improvement in ordinary shop training, the school has had no appreciable effect upon the same. Ordinarily the trade-school graduate can not take up the practical work in his trade without first undergoing a period of apprenticeship. Experience, facility, and speed of execution are essential in a thorough mechanic. These qualities can not be secured in a trade school, but must be acquired outside at real work. It is the combination of the trade school and the workshop that is best suited to modern conditions and always produces the best results. A course in a trade school gives the pupil a thorough knowledge of the use of tools and materials. It teaches him the theoretical and technical principles which apply to the particular trade he is studying, and gives him sufficient practical experience to enable him to do good work before he leaves the school. In every instance a trade-school training lessens the usual period of apprenticeship. In many cases the graduates have taken up practical work immediately after leaving the school and they have met with

the very best success. Some of them are among the leading employers and builders in their respective localities.

This school has proved eminently satisfactory and has long since attained the end for which it was established.

PRATT INSTITUTE, BROOKLYN, N. Y.

Pratt Institute, Brooklyn, was established in 1887, after several years' careful investigation of existing schools both in this country and in Europe, on the part of the founder, the late Charles Pratt.

The work of the institute includes industrial, trade, and technical education, as well as normal and general education in art, science, and literature. The fundamental idea, however, is industrial and technical education, and the normal and general courses have only come into the work in order to provide for certain local necessities, or to round out the curriculum and make it more complete in certain directions.

Mr. Pratt was a public-spirited citizen of Brooklyn, and the interest and pride which he took in the welfare of the city, together with his desire to do for boys what he had needed in his own youth, are responsible for the establishment of the institute.

Mr. Pratt felt that existing schools did not give the proper preparation for the life work of the great majority of our people who must needs earn their daily bread through their own toil and skill and practical intelligence. He believed that the training given to our American youths should be such as to give them some practical equipment which would better enable them to earn their own livelihood, and he hoped to make them better citizens by first making them more capable and intelligent workers, so that they could take more pride and pleasure in their daily occupations and be of more service to the community. He believed, furthermore, that some way could be found to make industrial skill and activity, the practical application of science, and many forms of art, enter into the system of education which would make it worth while for young men and young women to remain in school long enough to get a training which would directly fit them for their actual life work, and yet give them sufficient intelligence and character to enable them to grow into positions of greater responsibility.

The object of the institute, as stated in its catalogue, is: To promote manual and industrial education, as well as cultivation in science, literature and art; to inculcate habits of industry and thrift; to foster all that makes for right living and good citizenship, and to aid those who are willing to help themselves. It seeks to provide facilities by which persons wishing to engage in mechanical, scientific, artistic, educational, domestic, commercial, or allied employments, may lay the foundation of a thorough knowledge, theoretical and practical, or perfect themselves in those occupations in which they are already engaged. Its classes, lectures, workshops, library, reading room, and collections are designed to serve these purposes; and while tuition fees are

required, there is an endeavor to make possible, by some means consistent with self-helpfulness and self-respect the admission of every worthy applicant. The institute is based upon an appreciation of the dignity as well as the value of intelligent handicraft and skilled labor. It endeavors to give opportunities for symmetrical and harmonious education, to develop those qualities which produce a spirit of self-reliance, and to teach that personal character is of greater consequence than material productions.

In accordance with these principles, the work of the institute is prosecuted upon several lines, with four distinct aims in view:

1. Educational, pure and simple, the purpose being the harmonious development of the faculties, as in the work of the high school.

2. Normal, the ultimate aim being the preparation of the student to become a teacher. Normal training is at present given in the department of fine arts, in the department of domestic science, and in the department of kindergartens.

3. Technical, or special training to secure practical skill in the various branches of the fine, industrial, and domestic arts, the handicrafts, the applied sciences, and the mechanical trades.

4. Supplementary and special, intended for the benefit of those who wish to supplement the training of school or college by attention to special subjects conducing to more intelligent direction of domestic, financial, social, or philanthropical interests.

The institute occupies six buildings. The main building is 100 feet by 86 feet, and six stories high. The high-school building, completed January 1, 1892, is 48 feet by 81 feet, and is four stories high. The trade-school building, recently erected, is 32 feet by 110 feet, and four stories high. It contains large and well-equipped steam and electrical laboratories, as well as workrooms for the trade classes. The gymnasium building is 100 feet by 95 feet, and contains floor space for work, finely appointed bath and locker rooms, and a large swimming tank.

The buildings are of brick, with trimmings of stone and terra cotta, and are heated by steam and lighted by electricity. The main building is provided with a passenger elevator, which runs at all hours when classes are in session.

Regarded in the light of an educational force, the institute library has a responsibility second to none. It contains a stack room with a capacity of 200,000 volumes, a general reading room, a children's reading room, a general reference room, a special art and photographic reference room, class rooms, and workrooms. The building is fireproof, and is equipped, heated, and ventilated with the latest improved apparatus. The collection in the main library consists of about 67,000 volumes, in addition to which there are 7,500 volumes in a branch library, which is maintained for the use of residents in another part of the city.

The reference collection contains about 18,000 volumes, including reference books proper, sets of bound periodicals, Government and State documents, catalogues, reports and transactions of societies and institutions, and is free to all for consultation. Two of these rooms are fitted up as study rooms, with chairs and well-lighted tables, and are presided over by assistants well acquainted with the resources of the collection.

The reading room is supplied by purchase with 230 periodicals, and by gift and exchange with 91 additional. Of the first 207 are in English, 10 in French, 10 in German, and 3 in Italian.

There is also a separate library for children under 14 years of age, consisting of 2,535 volumes.

The library and its branch is free to all citizens of Brooklyn Borough for the home use of books, and to all persons for consultation. There is no age limit, children under 14 years being admitted to the privileges of the children's library.

Another important feature of the institute is its system of lecture courses given in the various departments. These bear directly upon the work of the institute in all its phases, and include practical instruction upon those matters which pertain to right modes of living, the problems of political and social economy, sanitary science, literary culture, art, etc. While many of these courses are given to pupils as a part of the regular work of the institute, many others are so arranged as to meet the wants of those not otherwise connected with the institute who wish the opportunity to obtain instruction upon subjects of interest and importance.

The institute possesses valuable collections of illustrative material, which are placed in the hallways and class rooms of the several departments. In the art reference room of the library building is a collection of 16,000 mounted photographs, illustrating architecture, sculpture, painting, and ornament. The special collection of textiles given to the institute in 1897 by Mrs. Charles Pratt is also in the library building. The collection of ceramics is arranged in the hallways of the department of fine arts on the fourth and fifth floors of the main building. The science and technology building contains the woods and minerals, as well as a collection of applied-art work in metal.

The regular school year opens in the latter part of September and closes the middle of June. The evening classes complete their work about the latter part of March. In nearly all departments morning, afternoon, and evening classes are held. The work of the different sessions is similar in character, although in the evening classes, and in those classes not meeting every day, the courses are of necessity abridged. Both sexes are admitted on an equal footing. The requirements for admission are as simple as possible, being intended to prove

only that the applicant has sufficient maturity and intelligence to profit by the work. The charges for tuition range as follows:

Art department: Full-day classes, $15 per term; half-day classes, $10 to $12. Evening classes, $5 per term for each course.

Department of domestic art: Day classes, sewing, drafting, and costume design, $15 per term; dressmaking and millinery, $25; art needlework, $5 to $10; basketry, $5. Evening class, sewing and basketry, $2; dressmaking, $5 to $10; drafting, $10; millinery, $5.

Department of science and technology: Day classes, $15 per term. In the evening classes the fee for the technical courses is $15 each for six months, except the courses in steam and the steam engine and strength of materials, which are $8 each per term. The fee in the trade courses is $15 each for six months' tuition.

New applications must be presented at the beginning of each school year, and renewal blanks at the opening of the winter and spring terms. Diplomas and certificates are granted for the quality of the work done and not for the number of years spent in study. Progress in all courses depends upon individual ability and application.

While the institute was established primarily for instruction in the trades, it has developed into its present organization by sheer growth of ideas and the force of experience and circumstances, and by the enlarging and broadening of the scope of its industrial training.

Under the present plan of organization the work of the institute is divided among the following departments: High school, fine arts, domestic art, domestic science, science and technology, kindergartens, libraries, and physical training. For the purpose of this report, however, only such courses as are of an industrial or technical character will be considered in detail.

In the high-school department there is a four-year course, which is intended as a course of general education. More than two-fifths of the entire time during the course is devoted to advanced manual training.

The object of the art school is to provide thorough and systematic instruction in the fine and decorative arts. The various divisions in the day school are as follows: Regular art course, which requires four years; and two-year courses in modeling, practical design, architectural drawing, art metal work, and wood carving.

There are also evening classes in general free-hand drawing, composition, cast drawing, life drawing, architectural drawing, decorative and applied design, clay and wax modeling, art metal work, and wood carving, which pursue lines of work similar to those of the day classes, but necessarily abridged.

In the department of domestic art there are courses in sewing, dressmaking, millinery, costume design, art needlework, and basketry. All these courses are technical in their purpose and are intended to fit

young women for different positions in the trades. The evening courses in this department include sewing, dressmaking, and millinery. The purpose of the department of domestic science is to afford training in subjects which pertain to life in the home, and includes the following courses: Normal course for teachers; general course, including bacteriology, home nursing and hygiene, plain cookery, household economics, laundry work, technical courses in cookery for nurses and housekeepers, and a serving course for waitresses. The evening courses embrace cookery for housekeepers, nurses, and cooks, a serving course for waitresses, and laundry work.

The department of science and technology takes in all the courses especially fitted for men. The following interesting statement regarding the general character of these courses, together with a brief sketch of their development and the need for such instruction, was kindly furnished by the director of this department:

The courses are divided into three classes, with somewhat distinct aims and objects for each. First, the day school provides technical courses in mechanical and electrical work which cover a period of two years; second, evening technical courses in physics, chemistry, applied electricity, mechanical drawing and machine design, steam and the steam engine, and strength of materials; and, third, evening trade classes in carpentry, pattern making, machine work, mechanical drawing, plumbing, sign painting, and fresco painting. While the evening courses from their name appear to be scientific rather than technical, yet, as conducted by the institute, they really come under the latter division, as they are intended for young men who are engaged in practical work during the day, but who do not understand the theoretical principles pertaining to the same. Thus, for young men who are employed in chemical manufacturing concerns and in other places where the knowledge of chemistry is absolutely essential to success, the course in chemistry is made as practical and technical as possible, applying directly to the needs of such men. The classes are made up almost entirely of this type of students. The evening trade classes are intended for young men who are engaged in the trades during the day, either as apprentices, helpers, or journeymen, and who wish to gain further knowledge, experience, and skill in order to get ahead.

The day courses do not offer a strictly trade instruction, nor do they afford a purely scientific training similar to the colleges of engineering. They attempt to occupy a place halfway between these two fields, to give young men a training which will enable them to rise above the grade of journeymen mechanics to positions as foremen, assistant superintendents, etc., and the experience of the institute shows that there is a very large class of these positions in connection with the design, construction, installation, and operation of all classes of machinery which call for this type of training, and which require men of sufficient intelligence and knowledge of fundamental principles to be able to grasp properly the plans of their superiors and direct their execution by the mechanics who do the actual labor.

The aim is to give sufficient practical trade instruction so that the graduates will be able in the drafting room or shop of any mechan-

ical or electrical plant, to find a ready demand for their services in these positions; but we have found that this can best be accomplished by at the same time giving them sufficient instruction in the fundamental principles of those sciences upon which their work is founded to enable them to advance to the more important positions when opportunity offers. When the institute was founded the idea was to make the instruction as practical as possible for the benefit of those who wished to enter any of those trades which are fundamental to the machine trade. There were day courses in carpentry, pattern making, machine work, etc., and eight hours per day were devoted to instruction along these lines in the shops, but we gradually discovered by experience that the type of American boy who ought to take up this line of work, if these industries were to continue their advancement in the world's competition, was not willing to enter any field of labor which did not hold out to his ambition a possibility of self-advancement. And for this reason, these purely trade classes were never very popular. But, more than this, we discovered that it was difficult to train young men to be good mechanics in our shops alone. The fact is that the difference between a good mechanic and a poor one is largely a question of intelligence and not of manual skill, and it is almost a universal rule that wherever you find a mechanic with a good head on his shoulders you find a good mechanic; and the converse is equally true, that wherever you find a really good mechanic you find a man of a very considerable degree of intelligence, at least along the lines of this particular work. As we gradually came to appreciate these facts, we introduced into the technical courses, along with the work in the shop or drafting room, courses in practical mathematics, physics, and elementary mechanics, bringing out clearly in the class room the principles on which the practical work depended. The success of this idea proved so great that more work of the same kind was introduced until about half of the time was devoted to work of this character and the other half to practical work in laboratory or shop, including several kinds of shopwork in each course instead of having the whole time spent in a single shop, thus giving the student a slight knowledge of several trades besides the one which he was likely to follow. I can not emphasize too much the need which I believe exists for this kind of secondary training, and additional proof of its need is coming to me every day. Indeed, it is of vital importance to all our industries that more adequate means be furnished for training the great number of young men who must enter them. A few years ago the commission which was sent over here from England to examine our industries and report to the English Government upon them gave as their reason for the remarkable success of American manufacturing enterprises the excellent public-school system, which gave every boy and girl a good knowledge of English and arithmetic; and unquestionably ability to read, to reason, and to calculate has had much to do in the past with the success and rapid advancement of the American mechanic and American industries. But to-day's methods of manufacture are becoming so complicated—and the introduction of science and scientific methods into all branches of industry and the rapidity with which changes in methods of manufacture are taking place make it necessary for the young man who is going to succeed in manufacturing establishments of any kind to have a training something beyond reading, writing, and arithmetic.

The old system of apprenticeship has gone, or is fast going, and nothing has yet been found to take its place throughout the country as a whole. Furthermore, there is a very strong feeling in many industries that it is becoming more and more difficult to get the right class of young men to enter them, and to get either skilled mechanics or efficient foremen, superintendents, and managers to direct the work.

On the other hand, more than half of the boys who graduate from our grammar schools do not enter the high school, and in the majority of localities nearly half of those who enter the high school leave at the end of the first or second year. The parents of these boys and young men are confronted with the question, Will it pay me to send my son to school for another year, or will he receive sufficient benefit from it to warrant my making the necessary sacrifice? The fact that such a very large proportion of the parents in the community answer this question as they do is proof to me that something should be done toward affording more adequate means for secondary technical education. Thus from all sides—from the manufacturer, who feels the need of more intelligent workers; from the young men, who desire a training which will directly help them in a practical way; from their parents, who have to make the sacrifice in order that they may get more training; from every direction—we are getting more and more proof of this need for the kind of technical training, adapted to the needs of those who are going to enter our industries as artisans, such as is here described.

Those courses which are industrial in their character are given more in detail in the following pages:

DEPARTMENT OF FINE ARTS.

The object of this department is to provide thorough and systematic instruction in the fine and decorative arts. The various divisions are as follows: Regular art course, modeling, design, architecture, art metal course, and wood carving.

Lectures are given on perspective, design, color, composition, and anatomy. A course of twenty-five illustrated lectures on the history of architecture, sculpture, painting, and ornament, given by the director of the department, is open to students of the institute and to the public. These lectures begin in October and occur on Wednesday afternoons at 4 o'clock.

Written application must be made for admission to all classes. Applicants for elementary and advanced courses in free-hand drawing must present such drawings and letters as will give evidence of ability to undertake the work. Applicants for the course in architecture and the course in design must take the special examinations explained in the descriptive text of these courses. No examinations are required of applicants for evening work.

All students are required to pursue various lines of work complementary to one another, which is made possible by the variety and number of classes.

There are also evening classes in general free-hand drawing, composition, cast drawing, life drawing, architectural drawing, decorative and applied design, clay and wax modeling, art metal work, and wood carving, which pursue lines of work similar to those of the day classes, but necessarily abridged.

All courses of study begin in September, punctually at the time announced for the various classes. The sessions are from 9 a. m. to 12 m. and from 1.20 to 4 p. m. on five days of the week. Evening classes meet for instruction Monday, Wednesday, and Friday from 7.30 to 9.30.

Regular art course.

This course occupies five days a week, and requires four years. The work of the first year consists of light-and-shade drawings from the antique, free hand perspective, sketching, elementary composition, and lectures upon the history of art. Opportunity is given in the afternoon for additional work in cast drawing, drawing from still life, and sketching from the costumed figure. Members of all-day classes who reach a required standard in drawing are allowed during the second half of the school year to work in color and to draw from life.

Portrait and life drawing, sketching, composition, and the study of anatomy are continued throughout the second year, and all students have opportunity to work in color.

The course for the third and fourth years is a further development of the second year's work. Students draw from the figure from life in the morning session, work in color in the portrait class in the afternoon, and continue the course in composition. On two days of the week opportunity is given to work from the model in action.

The study of composition is also a very important feature of the entire course. Subjects are assigned and composition drawings are required every week. A special advanced course is open to all students who fulfill requirements.

Classes in illustration are open to students of any year who reach a required standard.

Modeling.

The work of the classes is carried on in several divisions. The first provides training for those who wish to study sculpture as a profession, and every opportunity is furnished for serious and thorough work from the antique and from life. The second is intended to supplement free-hand drawing from the antique and from life. The third is planned to meet the requirements of pupils in the architectural, art metal, and wood-carving classes. Students model from casts, photographs, and plants, and study the principles of decorative design as applied to stone, wood, and metal. The course requires two years to complete.

Design.

This course requires an attendance of five days a week at both morning and afternoon sessions, the mornings being given entirely to design and the afternoons to design, free-hand drawing, and water color. Two years' attendance is called for to complete the course.

Applicants are admitted in September, and an examination is required in free-hand drawing from natural and decorative forms. The course of study is as follows:

Free-hand drawing: Practice is given in drawing from ornament, natural objects, and casts in outline and light and shade. Designs for household decoration require a clear understanding and a free rendering of perspective principles. The course therefore provides instruction in free-hand perspective and sketching, these subjects being studied in such a way as to enable students to render artistically the perspective appearance of common objects, furniture, and house interiors.

Water color: Light and shade drawing and free-hand sketching lead to water-color painting. The student selects and works from flowers and from groups of objects illustrating beauty of form and color, represents color effects and values in a simple artistic manner, and applies this knowledge in designs for interior decoration.

Historic ornament: Illustrated lectures are given on the history of art. The historic styles are studied and the typical features of each carefully worked out.

Principles of design and composition: Plan, order, repetition, radiation, symmetry, balance, proportion, and other principles are taught in both simple and complex designs. The essential qualities of design—simplicity, strength, stability, truth, and

beauty—and the treatment of motives in a manner literal, conventional, or symbolical are studied.

Applied design: Throughout the course much practice is given in applied design, including general ornament, surface patterns, borders, designs for tiles, book covers, prints, wall papers, carpets, metal, stained glass, furniture, and interior decoration. When students have become proficient in drawing and in general designing they may elect one or more subjects for professional work.

Architecture.

The training of students is accomplished by lectures, recitations, original investigation, and individual study and practice of the principles of construction and architectural design. The work occupies five days a week for two years.

Entrance examinations are held in June and September in free-hand drawing from ornament and common objects, in arithmetic, including fractions, percentage, proportion, square root, and mensuration, and in English grammar and composition. Applicants must be at least 16 years of age and must present a letter testifying to their general ability and moral character.

Students are admitted for special work if they give evidence of ability to carry on such work successfully.

The following subjects are comprised in the course of study:

Instrumental drawing: The work in instrumental drawing includes projection, descriptive geometry, projection of shadows, plans, elevations, framing plans, details of ordinary frame, brick, and stone construction, and instrumental perspective and cast shadows.

Free-hand drawing: This subject includes drawing of ornament from cast, free-hand perspective, light-and-shade drawing, pen and pencil sketching, and water color.

Construction: This subject is covered by a series of lectures upon the materials and processes employed in ordinary building operations. They are supplemented by problems from given data and by work in the department of science and technology, including practice in joinery, framing, and details of house construction, and by work in the testing laboratories.

Elements of architecture and architectural design: Lectures and exercises upon the forms and proportions of the Greek and Roman orders, balustrades, doors and windows, vaults and domes, are followed by problems in architectural design, drawn in plan, elevation, section, or perspective. The drawings are rendered in line, light and shade, or color. Furniture design is one of the special studies of the second year.

History: The study of the history of architecture is pursued by means of lectures and by reports from the students upon assigned topics. The reports are illustrated by drawings and sketches.

Mathematics and strength of materials: A course in algebra, plane and solid geometry, and trigonometry is followed by one in strength of materials, which by recitation and laboratory work takes up the stresses and strains in beams, girders, columns, roof trusses, etc., and also graphical statics.

Theory and practice: The purpose of the lectures introduced under this head is to show the relation of theory to practice. The subjects include the position of architecture among the arts, sanitation, and methods of office work.

Art metal course.

The art metal course, including chasing, engraving, die sinking, and enameling has been established in recognition of the ever-increasing demand for art work in useful objects and the difficulty experienced by manufacturers in securing the services of American artist-artisans whose knowledge of the crafts is sufficient to guarantee good workmanship. The instruction in drawing, designing, and modeling in the

course is given by the special instructors of these subjects, while the chasing, die sinking, engraving, and enameling are taught by one whose valuable experience as an expert craftsman amply qualifies him to train students for professional art work in silver, gold, and other metals. The course in both day and evening classes provides for practical application on a strictly professional basis, and students completing the course will be equipped not only with artistic appreciation and power of execution, but also with a knowledge of the requirements of the trade.

Wood carving.

This course aims to give students a general training in the fundamental principles of art in drawing, design, clay modeling, and historic ornament, while practical application of these principles is made in the special work of wood carving. The full course requires five days a week for two years.

The course includes preliminary exercises in the care and use of tools, horizontal and vertical decoration, plane and curved surface carving, incised model carving, low relief, high relief, letters and inscriptions, cabinet work in historic styles, and sculptured ornament. A course in light carpentry or cabinet work may be taken in the department of science and technology.

DEPARTMENT OF DOMESTIC ART.

The courses in this department include sewing, dressmaking, millinery, costume design, art needlework, and basketry.

All courses begin in September. Classes in the special courses for use in the home are organized also, so far as accommodation will permit, at the beginning of the winter and spring terms. The school year is divided into three terms of three months each, beginning in September, January, and April.

In all branches of instruction there are morning, afternoon, and evening classes, except in art needlework and drawing, which are restricted to mornings and afternoons.

Evening classes in sewing, dressmaking, and millinery meet twice a week during the fall and winter terms. The courses of study differ from those of the day classes and are arranged with reference to the needs and limited time of the student.

Lectures on subjects closely related to the work are given during the year. All institute lectures are open to the students of the department. The director gives a course of ten lectures on historic costume from the earliest times to the present. These are illustrated by lantern views of famous portraits and of French costume plates. The aim of these lectures is to make the students acquainted with the styles of costume worn in different countries during noted epochs, and special attention is called to the designs most effective and most readily adapted to modern dress. These lectures are open to the public as well as to the students.

Sewing.

This course is organized in September only. It has been arranged for those who can devote their whole time for a year to the study, and work at home is required. The first half of the year is devoted to practice in the various kinds of hand and machine sewing, and to learning the principles of drafting, cutting, and fitting undergarments and children's dresses. Students who satisfactorily complete this part of the course may take orders for work, and thus put into practice the principles already learned. Instruction in all kinds of mending is included in the course, that all branches of the work may be covered, and throughout the course the student is given opportunity to develop her own ideas in design and color.

This course is considered necessary as a preparation for the dressmaking training of those who have had but little experience in hand sewing or simple garment making.

Applicants should have some experience in hand sewing, and should be at least 15 years of age.

Dressmaking.

This course is arranged to give a thorough training in the principles of dressmaking, with as much practice in their application as the time will allow. It fits the pupils to do intelligent work, under direction, in an establishment. An opportunity will be offered in a second year to those who give evidence of ability in cutting, fitting, and designing to do more independent work, until they prove themselves competent to be recommended or to receive a certificate.

This class is organized in September only, and continues through the school year. Sessions are held daily, except on Saturday. Two afternoons in a week are given to the course in design, and the students attend the lectures on the history of costume.

Applicants must be over 16 years of age and have some knowledge of the making of dresses from pattern. They must bring for inspection a dress proving their ability to do good work, and must pass a written examination on the making of a simple dress. Women who have had previous experience in dressmaking may be admitted to advanced work upon passing an examination which will prove their fitness.

The course of study comprises drafting, cutting, and fitting unlined shirt waists and skirts; instruction in drafting skirts and waists with chart; exercises with practice material in fitting and designing and in making dress trimmings and finishings; study of color, form, line, and texture; drafting and making walking skirt; cutting, fitting, and making lined waist; study of the contour and poise of the body; matching stripes and plaids; drafting and making princess gowns; practice in designing; study of artistic principles; drafting, cutting, and making jacket; study of woolen textiles; drafting and making evening gown.

Drawing, water color, elementary design: Practice in the use of the pencil and of water color; appearance of objects, bows, gowns, and drapery; outline and proportion of the human form; study of historic costume; practice in designing gowns for home and evening wear.

Drafting by chart is taught in a separate class to dressmakers or to those who wish to be able to draft patterns for themselves or their families.

For those who already have a knowledge of dressmaking and wish to learn how to do ladies' tailoring a course is offered in the making of jackets and coats.

Millinery.

The object of this course is to afford training in the practical and artistic principles of millinery according to the best methods, and also to cultivate taste in color and design as related to costume. The class, completing in four months the full course, is organized in September and February, and has been arranged for those who wish to prepare to become milliners. The class meets daily, except on Saturday. Part of the time in the afternoon is devoted to the course in design. There are also lectures upon hygienic, artistic, and historic dress, and instruction is given in the methods of keeping accounts.

Applicants must bring for inspection a hat showing some talent in the trimming and making, and they should be able to work rapidly, since the time devoted to this course is short, in order to be ready for the workroom seasons. The class organized in September prepares students to take positions at the opening of the spring season, while the class beginning in February fits them for the fall season. They should be over 16 years of age and able to do good hand sewing. Familiarity with the use of the tape measure and ability to cut accurately are requisites.

In the course of study are included facing and finishing hat brims; making bows; trimming hats; study of form, line, color, and textiles; designing, drafting, and making frames; making and trimming covered hats and bonnets; making velvet hats and bonnets, toques and evening bonnets; making wire frames and straw hats; lace and shirred hats and bonnets; children's hats.

Drawing, water color, elementary design: Practice in the use of the pencil and of water color; appearance of objects, drapery, bows, hats; outline and proportion of the head; study of historic costume; designing of hats.

Costume design.

The object of this course is to train students to become illustrators or designers of costume. Three years are required. The first two years are spent either in the regular art course or in the two-year course in design in the department of fine arts. The entrance examination is the same as for those courses. The instruction is given in the regular classes of that department, and embraces cast drawing from ornament and the antique, freehand perspective, color, life, and portrait drawing, sketching from the figure, composition, design, and the history of art.

A part of the second year and the whole of the third year are given to special study of costume design in the department of domestic art. The work covers study of the figure and head, and sketching and designing costumes in pencil, ink, and water color. The study of historic costume is included in the course, and students attend the lectures on this subject and on the history of art. The full time of the student is required throughout the three years.

To enter upon the special work of the third year, students must perform in a satisfactory manner the work of the first two years in the department of fine arts and also submit such sketches of the costumed figure in pencil and water color as will prove their ability to undertake the special work of costume design. Applicants who have had thorough training elsewhere and wish to enter advanced classes must present such drawings as will justify their admission.

Art needlework.

This course of two years is for those who desire to make a profession of art needlework, as well as for those who wish a knowledge of the principles and methods of the art for use in home decoration. The instruction cultivates artistic feeling and judgment in the choice of design, color, and texture.

The study of drawing and design, which is necessary for a correct appreciation of artistic needlework and the development of originality, is taken up two mornings in the week. The remaining sessions are devoted to the study of the varieties of stitchery.

DEPARTMENT OF SCIENCE AND TECHNOLOGY.

The instruction afforded by this department of the institute includes the two-year technical course in steam and machine design and in applied electricity, besides a number of evening technical courses and evening trade classes.

Steam and machine design.

The primary aim of this course is to furnish as sound and complete a technical and mechanical training as is possible in the limit of two years, and it is especially designed to furnish those who wish to enter manufacturing or industrial pursuits or in other ways come directly in contact with the design, construction, and operation of machinery of any kind, with a training which will be of immediate value to them, and, at the same time, one which is thorough enough to enable them to rise to positions of responsibility.

It is not the aim of the course to train the professional or expert engineer, but rather to give young men who wish to enter mechanical enterprises, either in the drafting room or shop, a training that will especially fit them for positions as designers of machinery or supervisors of its construction and operation. For this

reason much time is devoted to the subjects of machine design and machine construction, so that the graduate may be familiar with the processes and treatment of material in different lines of manufacture, and thus be able to intelligently superintend and direct them. The following is the course of study:[a]

FIRST YEAR.

Fall term.	Winter term.	Spring term.
Mathematics (algebra) 5	Mathematics (plane geometry) 5	Mathematics (plane trigonometry) 5
Physics (mechanics) 5	Physics (heat) 5	Physics (electricity) 5
Physical laboratory 4	Physical laboratory 4	Physical laboratory 4
Mechanical drawing (projections) 5	Mechanical drawing (shop drawing) 5	Mechanical drawing (engine details) 5
Freehand drawing 1	Freehand drawing 1	Freehand drawing 1
Shopwork (carpentry and pattern making) 5	Shopwork (foundry and forge) 5	Shopwork (forge and vise work) 5

SECOND YEAR.

Mathematics (advanced algebra) 5	Mathematics (solid geometry) 5	Mathematics (analytical geometry) 5
Mechanism 5	Steam engine and steam boilers 5	Mechanics and strength of materials 5
Machine design 5	Machine design 5	Machine design 5
Mechanical laboratory 4	Steam laboratory 4	Strength of materials (laboratory) 4
Shopwork (machine work) ... 5	Shopwork (machine construction) 5	Shopwork (tool making) 5

Applied electricity.

It is the aim of this course to furnish special and practical training which will qualify the graduates to fill such positions as operators, superintendents, and managers of electric lighting, railway, and power plants; constructors, and designers in some of the various lines of applied electricity; or commercial and executive positions connected with the business end of such industries.

The course of study is as follows:[a]

FIRST YEAR.

Fall term.	Winter term.	Spring term.
Mathematics (algebra) 5	Mathematics (plane geometry) 5	Mathematics (plane trigonometry) 5
Physics (mechanics) 5	Physics (heat, light, sound) .. 5	Physics (electricity) 5
Physical laboratory 4	Physical laboratory 4	Physical laboratory 4
Chemistry (nonmetals) 2	Chemistry (metals) 2	Chemistry (qualitative analysis) 2
Chemical laboratory 2	Chemical laboratory 2	Chemical laboratory 2
Mechanical drawing (projections) 3	Mechanical drawing (shop drawing) 3	Mechanical drawing (engine details) 3
Shopwork (carpentry and pattern making) 3	Shopwork (pattern making and foundry) 3	Shopwork (forging) 3

SECOND YEAR.

Mathematics (advanced algebra) 5	Mathematics (solid geometry) 5	Mathematics (analytical geometry) 5
Mechanics (steam) 3	Mechanics (prime movers) ... 3	Mechanics (strength of materials) 3
Applied electricity (generation) 2	Applied electricity (transmission) 2	Applied electricity (motors and lighting) 2
Applied electricity (laboratory) 4	Applied electricity (laboratory) 4	Applied electricity (laboratory) 4
Mechanical drawing (dynamo details) 3	Mechanical drawing (wiring plans) 3	Mechanical drawing (power plants) 3
Shopwork (forge, vise work) .. 3	Shopwork (machine work) ... 3	Shopwork (dynamo construction) 3

[a] The figure after each study represents the number of periods a week. All periods in drawing, shopwork, and laboratory are 2 hours long; all other periods are 1 hour each.

EVENING TECHNICAL COURSES.

The following evening courses are provided for those whose regular occupation prevents them from attending a day course. The aim is, so far as the time allows, to furnish a thorough and practical training in the various branches which will be of immediate value to the student, not only by increasing his general information, but also by enabling him to advance to positions of greater responsibility in his special line. By attendance in succession upon several of these courses a fairly complete mechanical or electrical course may be obtained.

In these courses the theoretical instruction in every case is supplemented in each session by individual practice in the laboratories or drawing-rooms, and all of the apparatus and laboratories of this department are available for these classes.

The outfit lent each student includes everything needed for the most thorough individual work, and the size of all the classes is limited so that each student may have abundant room to carry on his work under the personal oversight of the instructor.

Entrance examinations in arithmetic and algebra through simple equations are required for the course in applied electricity, and one in arithmetic for the courses in steam and the steam engine, and strength of materials.

Applicants who have taken the course in physics will be given preference in admission to all the other courses.

All classes meet on Monday, Wednesday, and Friday evenings from 7.30 to 9.30 between September and March. The courses of study are as follows:

Physics (one year): Principles of mechanics; equilibrium of forces, pressure of gases, laws of motion, work, energy, and friction; heat and ventilation; magnetism, static and current electricity, and electrical measurements. Two lectures and four hours of laboratory work each week.

Chemistry (three years): First year—Principles of general chemistry and of chemical combinations, properties of the nonmetallic and metallic elements and their compounds. Second year—Qualitative analysis; solubility of different substances; analytical reactions of each base; analysis of solutions and solids; and determination of acid radicals. Third year—Quantitative analysis, gravimetric and volumetric; assaying and elements of organic analysis. Lectures and laboratory throughout the three years.

Applied electricity (one year): Lectures and laboratory practice in operation of dynamos and motors; principles of dynamic electricity and magnetism and their application in practice.

Mechanical drawing (two years): First year—Use of instruments; principles of working drawings; projection and shop drawing. Second year—Advanced drawing; machine design.

Mechanism (one year): Lectures and drawing. Mechanical movements carefully analyzed and worked out on the drawing board. Problems on cams, gear teeth, different forms of link work, etc. The course in mechanical drawing or an equivalent is required for admission.

Steam and the steam engine (first term only): Lectures dealing with laws of heat, combustion of fuel, and steam generation; properties of steam; condensing and noncondensing engines; value of single, compound, and triple expansion. Laboratory practice in setting slide valves, taking indicator cards, and calculating horse power and other data, and making tests of engine efficiency.

Strength of materials (second term only): The instruction deals with the stresses and strains in floors, beams, and girders, columns, shafting, boilers, and riveted joints, etc., and the behavior of the material of construction under such strain. Individual experiments and tests on large specimens form an important feature of the work.

EVENING TRADE CLASSES.

The evening trade classes aim to furnish a thorough practical training in the various trades which will be of immediate value to each one attending by giving him skill, accuracy, and a thorough knowledge of the technical points of his trade, familiarizing him with modern methods, preparing him for advancement, and increasing his earning power.

Each one of the shops is provided with all the machines, tools, or special apparatus for the particular trade which can promote the objects and increase the value of the instruction.

Applicants for these evening trade classes must be between 16 and 25 years of age, and applications should be made before the term opens.

All classes meet on Monday, Wednesday, and Friday evenings from 7.30 to 9.30, from September to March. The courses of study comprise:

Carpentry (two years): Practice in use of carpentry tools, instruction in joinery, practical examples of house framing, doors, sashes, etc. Also an advanced course, taking up problems in roof framing, stair building, or pattern making, as the student may elect.

Machine work (two years): One term of bench work and one term of practice on the engine lathe, planer, shaper, and milling machine. This is followed by actual machine construction and high-grade machine work, including tool making, with considerable practice on the milling machine and grinding machine. Experienced machinists will find this work of great value.

Plumbing (two years): The Journeymen Plumbers' Association of Brooklyn cooperates in the direction of this class, and awards certificates to those showing satisfactory proficiency, which entitle the holders to admission to the association. The manual work includes practice in soldering and wiping the various types of joints; making bends, traps, and other practical work. The lectures deal with the proper arrangement of drain, soil, and waste pipes; trapping; ventilation; supply pipes; boilers; tanks; fixtures, etc.

Sign painting (two years): Practice in spacing and plain lettering; ornamental lettering in gold and colors on wood, glass, and metal. Also composition of signs; scroll work; wagon painting; striping; and pictorial work.

Fresco painting (two years): Preparing walls and ceilings in calcimine; lining; stencil work; flat and shaded ornament; flower painting; and paper hanging. Study of design and advanced ornamental decoration on wall and ceiling.

The institute is under the control of a board of trustees, with a secretary as executive officer, and a faculty composed of 7 members, each one of whom is the director of a separate department. Altogether there are 128 instructors, of whom 75 are engaged in the departments considered in this report. Most of the instructors are graduates of colleges or scientific schools, and many of the technical instructors were educated in the institute. In the trade work the instructors are men who have gained prominence in their several trades and are, for the most part, self-educated or were trained in the institute.

The number of students enrolled in the departments herein considered during the year 1900-01 was as follows:

STUDENTS ENROLLED IN SELECTED DEPARTMENTS OF PRATT INSTITUTE, 1900-01.

Department.	Day courses.	Evening courses.	Total.
Fine arts (a)	283	220	503
Domestic art (b)	464	72	536
Science and technology	117	346	463
Total	864	638	1,502

a Not including 245 students in the normal and children's classes.
b Not including 195 students in the children's classes and those who take instruction for home use.

In the day course in the department of science and technology the several branches are combined. In the evening course each subject may be, and usually is, taken separately. Of the 346 pupils in the evening courses the following is the number in each class:

Evening technical.		*Evening trade.*	
Physics	24	Carpentry	26
Chemistry	48	Machine work	44
Applied electricity	25	Plumbing	54
Mechanical drawing and mechanism	59	Sign painting	16
Steam and steam engine	21	Fresco painting	11
Strength of materials	18	Total	151
Total	195		

The department of domestic science is not considered in detail for the reason that the classes are made up almost wholly of normal students, children, and those who take instruction for home use. There were 310 students in this department. The diploma of the institute is given to those students who successfully complete the normal and high school courses.

The certificate attests the successful completion of any of the day courses representing from one to four years' work in the departments of fine arts, domestic art, science and technology, domestic science, and libraries. As diplomas or certificates are not awarded to students in the evening classes, it is impossible to state exactly the number of graduates. It is safe to assume, however, that out of more than 40,000 individual students who have received instruction in the institute at least 10,000 have completed the courses covered by this report.

The cost of the buildings, grounds, and equipment of the institute is approximately $1,200,000. Everything was provided for by an endowment fund given for the purpose by the founder, and this fund has been added to by the trustees of the Pratt estate. At the present time the fund amounts to $2,500,000. Approximately $250,000 annually is required for the maintenance of the work of the institute.

This amount is derived almost entirely from the endowment fund, with slight addition from tuition fees.

In the opinion of the officials the courses of study prescribed are founded on wise lines. They are improving in detail as experience increases and it is found possible to introduce into the work more of true art or more breadth of technical and scientific training. Regarding the benefits accruing to local industries, it is difficult to definitely determine what practical benefits have accrued to the industries in the locality as the result of the establishment of the institute. The indirect influence is oftentimes as important as the direct. A large institution with high ideals does much toward elevating public sentiment, awakening new standards of excellence and new lines of thought in many ways and in many places, and these are things which it is impossible to measure. High standards of work and the amount one expects to be able to accomplish in a given length of time always increase as the possibilities for accomplishment increase; so that it would be impossible for the most accurate observer to give an exact estimate of the influence that any school has had on any special industry. Nevertheless evidences come from many sources that the institute is exerting a very strong influence for good and that these benefits reach over a very wide area, including, to some extent at least, a large part of the entire country.

The trustees feel that the large sum of money expended annually yields the greatest possible return, because of the influence it is exerting on the community and the country at large; and the very high regard in which the institute is held by everyone who speaks of it is, to some extent, an indication of the great good that it is doing.

The following statement regarding the evening trade class in machine work conveys some idea as to the local influence in one particular line: For this class, which is limited to 50 students, there were at the opening session last year 200 machinists who were anxious to be admitted, simply because they were aware of the benefit that the instruction had been to others in their trade, and more than 100 of those who could not be accepted wished their names placed on the waiting list for next year.

In the early history of the institute there was some opposition from one of the local labor unions, which arose from a misconception of its purpose and was not well founded. During the past ten years the Journeymen Plumbers' Association of Brooklyn has cooperated in the direction of the class in plumbing and awards certificates to those showing satisfactory proficiency, which entitle the holders to admission to the association. The Master Painters' Association cooperates with the evening classes in sign and fresco painting in a similar way and grants certificates, to those showing proficiency, at the completion of the course. A recent number of the institute monthly contains

ample evidence as regards the benefits derived by those who have been under instruction in the institute, and the alumni notes show a list of more than 100 students who have graduated in the past five years and are now holding important positions in leading industrial establishments throughout the country.

In speaking of the success met by the students of the evening trade classes, the record of the class in plumbing for the year 1895–96 was referred to. There were 49 members in this class and a recent effort to ascertain their whereabouts resulted as follows:

Nine could not be located, 1 was in Manila, 1 perished on the Maine, 22 were regular journeymen plumbers, 7 were master plumbers, 5 were salesmen in plumbers' supply houses, 1 was superintendent of a large plumbing firm, 1 was a draftsman on plumbing plans, 1 was a sanitary engineer for a trade paper, and 1 (the only one who had left the trade) was a policeman. Thus, of the 40 members heard from, many had, in the short time since they left the institute, stepped up at least one notch in the social scale, and instead of getting 75 cents or a dollar a day as plumbers' helpers, were receiving at least the regular journeyman's wages of $21 per week. Nearly half had stepped up another notch and were doing even better, as master plumbers, salesmen, and the like. This is an exceedingly creditable record. In the evening classes these young men had been taught to think in connection with their work, and they have kept on thinking ever since in competition with men who are not in the habit of putting over-much thought into what they do. The result is that they have begun to advance in the industrial scale, and in all probability they will continue to get further ahead so long as they continue to work more intelligently than those with whom they come in contact.

In the matter of receiving preference over shop-trained apprentices and workmen, it is pointed out that the civil-service examinations in Greater New York City for licensed plumbers, plumbing inspectors, and the like ask as their first question, "Are you a graduate of any trade school?" and give an increased per cent for an affirmative answer. It is seldom that a graduate fails to obtain a good position if he takes a letter of recommendation from the institute. One leading manufacturer, of national repute, states that he can always find room for any young man whom the institute will recommend. Yet many of the firms who can find room for the graduates in their works have from 100 to 200 applicants on their waiting lists. Good positions and better opportunities await the graduates each succeeding year. The reputation of the institute and the character and ability of its graduates have become so thoroughly established that some of the leading manufacturers of the country have expressed the desire to employ all the young men who complete the courses in the day school. Some idea of the demand for young men of this class may be had from the

fact that within six months after the last graduation the institute had applications for more than four times as many graduates as there were in the day classes.

As regards the possibilities of a trade or technical school graduate taking up practical work without undergoing a period of apprenticeship, it is said, "no school can turn out a finished workman. The time is too short to give the necessary experience, and it would be unwise to prolong the course of study to a point where all the necessary experience could be gained in the school. In general, the school has accomplished its object if the fundamental principles underlying the trade have been taught, and intelligence and skill and breadth of mind have been acquired, so that the graduate may find ready employment and have the power to rapidly acquire the necessary experience in practical work to enable him to rise to responsible positions." In very many cases, where the graduates follow a trade, the period of apprenticeship is shortened considerably, as their progress depends upon their ability to do good work rather than the number of years that they have been engaged in the trade.

The institute has proved highly satisfactory in every particular, but it has never fully attained the end for which it was established, for its ideals and aims are very far-reaching. The fact that from a small beginning of 12 students in 1887 the institute has grown so that it is to-day giving instruction to 3,474 students, and in the past fourteen years has given instruction to more than 40,000 individual students shows in a general way that the public have confidence in its methods and work and that it has achieved well-deserved success. The institute has lost the direct inspiration of its founder, who was personally in touch with the work during the first four years of its existence, and to whom, more than to anyone else, is due the spirit of loyalty, cooperation, and unselfishness which pervades its activities. The usefulness of the institute is widened as the number of its graduates is multiplied and as they carry its methods and ideas abroad.

In the growth and development of the institute the trustees and the faculty have kept close to the original ideas of the founder, and no better proof could be found of the fundamental truth underlying these ideas and the urgent necessity for the kind of industrial and technical training that it stands for than in the remarkable growth of this institution since it first opened its doors to the public.

ST. GEORGE'S EVENING TRADE SCHOOL, NEW YORK, N. Y.

This school was established in New York City in the fall of 1892, and by its useful career has firmly established itself as a valuable adjunct of St. George's Protestant Episcopal Church.

Started primarily as a boys' club, to bind the boys together, amuse them, and keep them from the streets in the evening, it has now become

a salient factor in their lives, enabling them to select the lines of work for which their characters and dispositions are best adapted, and to become eventually skilled mechanics. The school, with its evening classes, allows not only the boys who go to the public schools to attend, but also the young men who work during the day in stores and offices. Theoretical instruction in the form of short lectures is given each evening in the class rooms on subjects which, bearing directly upon the work in hand, tend to open the eyes of the pupils to facts closely related to their studies and acquaint them with the rapid strides being made outside the school in their special line of work.

In addition to the benefits derived from the school, there is an employment bureau, which is conducted for the purpose of finding positions for the boys which will enable them to work during the day at the trades they are being taught in the evening, thereby insuring a livelier interest in the work as well as more lasting impressions derived from it. The church also conducts a manual training school for boys under 10 years of age, from which a large proportion of the pupils in the trade school are drawn.

The school year opens on the third Monday in September and closes on the last Friday in May. Tuition is free. All pupils must be members of St. George's Sunday School and over 10 years of age. Sessions are held every evening except Saturday and Sunday, from 7.30 to 9 o'clock. The school is closed on all legal holidays, as well as for about ten days during the Christmas holidays.

The course of instruction covers a period of three years, and embraces carpentry, plumbing, printing, and free-hand and mechanical drawing.

The drawing department covers effectually all the practical instruction necessary to a mechanic or artisan in geometrical, mechanical, working, machine, and free-hand drawing.

The carpentry department, which is elaborately equipped with all modern bench tools, takes in not only carpentry, but joinery, pattern making, and cabinetmaking, devoting varying periods of time to the boys in each kind of work, as evinced by their ability to stride with or ahead of their classmates.

The printing department includes in its work the issuing of the Industrial Herald, a school paper printed monthly by the boys. This department embraces in a very practical sense all the work in a printing office from typesetting to presswork.

The plumbing department is devoted entirely to plumbing and gas and steam fitting. A visit to this department when in operation is not dissimilar to a visit to any outside shop, as each piece of work is stamped with its own utility.

The general management is vested in a board of directors chosen by the church. There are 6 instructors, of whom 1 is a college graduate,

and the others are men who have received a practical training in the trades. The number of pupils in each department and class during the year 1900–01 was as follows:

PUPILS IN EACH DEPARTMENT OF ST. GEORGE'S EVENING TRADE SCHOOL, 1900-01.

Department.	First-year class.	Second-year class.	Third-year class.	Total.
Carpentry	40	20	20	80
Plumbing	24	20	16	60
Printing	25	20	15	60
Free-hand and mechanical drawing	30	30	20	80
Total	119	90	71	280

In addition to the above there were 85 pupils in the manual-training school. In past years a large proportion of the pupils failed to complete the full courses, and therefore the number of graduates is small. Thus far only 260 diplomas have been awarded by the school. The present school building is located at 505 East Sixteenth street, and was occupied for the first time in the fall of 1900. It is a four-story brick structure with about 8,000 square feet of floor space, and together with the equipment cost about $8,000. The funds for the building and equipment were furnished by a prominent member of the church. This same member pays the expense of maintaining the school, which amounts to $5,000 per annum.

The benefits accruing from the establishment of the school are apparent to all. It has attracted many boys to the Sunday school and the church. It has brought them in contact with men of high ideals, and has exercised a very considerable influence toward promoting industrial, educational, and social development in the community. The effect upon those who have been under instruction has been beneficial in every respect. The school has helped the boys to be accurate in the use of hands and head. They have been fitted to take up trades which pay them from $12 to $20 per week, rather than store or office positions which are always crowded and afford small compensation. Their training has stimulated them with the desire for more advanced education, which many have obtained in the higher technical schools. As a rule, they have received higher wages and had steadier employment than those boys in the Sunday school who have not attended the trade courses. It is said that, having had the advantages of individual instruction such as do not ordinarily obtain among employees in the average workshop, the graduates are preferred by employers over shop-trained apprentices.

The school does not claim to turn out skilled mechanics. The main object is to train the pupils so that when they leave the school they can take up positions as apprentices or helpers in the several trades with the cheerful prospect that the knowledge they have already acquired will enable them to make rapid advancement to the higher positions. The officials state that the courses of training and study

could be improved by extending the scope of the work and by having additional equipment in some of the class rooms. At present the outlook for this is uncertain.

The school has proved satisfactory in every way. It has demonstrated its value in training pupils, not only for their life work, but for their general usefulness in the community. It forms the principal work of the church among the boys and young men, and has fully attained the end for which it was established.

M'ALPIN TRADE SCHOOL, NEW YORK, N. Y.

Like the St. George's Evening Trade School, which is connected with St. George's Episcopal Church, the McAlpin Trade School had its origin in a boys' club connected with the West Side Mission of the Brick Presbyterian Church located at 410 Fifth avenue, New York City.

The boys' club was established for the purpose of providing a place where the boys in the vicinity of the church might spend the evenings in innocent amusement, etc., the main object being to make the club and its privileges sufficiently attractive and entertaining to induce the boys to pass the time there and thus be the means of keeping them from the streets. In the fall of 1900 the church officials concluded to enlarge the scope of the club and if possible make it more useful and more productive of practical benefit to the boys. With this purpose in view the trade school was established. The boys' club is nonsectarian. The cost of membership is 10 cents per month for boys under 16 years of age, and 20 cents per month for boys over 16 years. The privileges of the club include the use of the library, reading room, game rooms, gymnasium, athletic grounds in the summer, free admission to church entertainments, and free tuition in the trade school.

All pupils must be members of the boys' club. The school opens the first week in October and closes the last week in June. Sessions are held every evening in the week except Sunday from 7.30 to 9.30. The present courses of instruction include carpentry, iron work, and free-hand drawing. There is also a course in manual training for the smaller boys. The school is under the management of a council, which is composed of prominent members of the church. There are 5 regular and 7 assistant instructors, all of whom acquired their training in practical work. The number of pupils in each class during the past year was as follows: Carpentry, 25; iron work, 32; free-hand drawing, 32.

As the course of instruction covers a period of three years, it is too early yet for the school to have any graduates. The building and equipment cost $27,000, which amount was donated by a prominent member of the church. The school is maintained by the Brick Presbyterian Church. The cost of maintenance during the past year was about $2,500. The officials state that the school is greatly in need of

more space, and that the courses of training and study could be improved by extending the scope of the work so as to include plumbing, printing, machine work, and mechanical drawing. The outlook is very promising. Tentative plans have already been made for a new school building that will accommodate 500 pupils.

The school has not been long enough in existence to have accomplished anything definite in the way of benefiting local industries or those who have been under instruction. It is a new feature of church work, and the results already attained are both pleasing and satisfactory and are such as to warrant the prediction that the future is full of promise both for the school and the boys and young men who will be so fortunate as to be able to attend it.

BARON DE HIRSCH TRADE SCHOOL, NEW YORK, N. Y.

The Baron de Hirsch Trade School in New York City is one of several similar institutions which have been established, both in this country and in Europe, through the munificence of the late Baron de Hirsch. In keeping with his general purpose to aid indigent Hebrews in Hungary, Russia, Galicia, and Roumania to emigrate to other countries and there establish themselves upon a self-supporting basis, Baron de Hirsch created what has since been known as the Baron de Hirsch fund for the benefit of needy Hebrew immigrants in the United States. In February, 1891, the fund, amounting to $2,400,000, was conveyed to a board of trustees in New York City to be invested in the United States. The specific purpose of the fund is to furnish mechanics with tools, teach easy trades, aid in securing employment, and in exceptional cases to be loaned out to immigrants until they become self-supporting. Besides establishing colonies in various States and aiding in the education of Hebrews in all the larger cities, the trustees have also established a flourishing agricultural school at Woodbine, N. J., where, in addition to teaching everything pertaining to the art of agriculture, the pupils also receive instruction in manual training and industrial work.

The object of the trade school is to fit young men in as short a time as possible to enter one of the mechanical trades for a livelihood. All instruction is free and is limited to Jewish young men. Preference in admission is made in the following order: (1) Those born in Russia and Roumania, (2) those born elsewhere in foreign countries, (3) those born in the United States of foreign parentage, (4) those born in the United States of American parentage. Applicants must be able-bodied and at least 16 years of age and must show that they have some means of support while in attendance, as nothing in addition to the instruction is provided by the school. All applicants are taken on trial for the period of fourteen working days, at the end of which time, if the applicant shows that he possesses sufficient ability to learn a trade

and has proved himself worthy of acceptance as a pupil, his name is enrolled as a member of the school. Applicants are assigned to whatever course they seem best adapted for, due regard being given to their own inclination as to the trade they wish to learn. No certificate is given to any pupil who does not remain throughout the entire course.

For the present there are day classes only. Owing to lack of interest the evening class in elementary mathematics, which was intended for those engaged in mechanical work during the day, has been abandoned. The school year is divided into two terms of five and a half months each. The winter term begins the 1st of February and the summer term on the 15th of August.

The aim of each course is to give the pupil a practical working knowledge of some trade; with this in view, the first few months of each course are devoted to gaining a knowledge of the principles of each trade, the latter months to practice, showing the application of these principles.

Shop methods, in practice, are followed as closely as possible, and each pupil is required to keep a notebook in which all practical points given by the instructors in lectures are required to be copied. All work is, as far as practicable, done from working drawings, and instruction in mechanical drawing is given to enable pupils to read and work understandingly from such drawings.

For those pupils ignorant of English, instruction is provided in that language, and certificates will not be given to pupils who, at the end of their course, can not read and write a fair amount of English.

At the satisfactory termination of any one of the courses, each graduate is given a kit of tools and a certificate stating that he has completed one of the courses offered by the school.

The sessions are held on Mondays, Tuesdays, Wednesdays, and Thursdays, and the hours are from 8 a. m. until 5 p. m., with an intermission of one hour at noon. On Friday the school closes at 4 p. m. The school is closed on all legal and Jewish holidays, and from July 15 to August 15 of each year.

The courses of instruction include carpentry, plumbing, machinists' work, house and sign painting, electric wiring, bell work, etc. Lectures are given throughout the course showing the principles involved, and explaining the various uses of tools, materials, etc.

The school is under the general management of an advisory committee. There are 8 instructors, each of whom acquired proficiency through work of a practical nature in his trade. The number of pupils in each class during the last session was as follows: Carpentry, 15; plumbing, 15; machinists' work, 15; house painting, 15; sign painting, 15; electric wiring, etc., 15. Certificates of proficiency have been awarded to 432 pupils. The school building, which was completed in

1899, is situated on East Sixty-fourth street. It is a handsome four-story brick structure, with stone trimmings, and furnished throughout with all modern improvements. The class rooms are large and have ample light and ventilation, and are equipped with the latest facilities for instruction in the trades. The building and equipment cost $175,000, and the cost of maintenance during the year 1900–1901 was $16,500.

In the opinion of the officials, the courses of training and study are quite satisfactory. The effect upon those who have been under instruction in the school has in every instance been found to be most beneficial. So far as known, the school has been neither favored nor opposed by labor unions. It is the policy of the school to work in harmony with the labor unions, and the graduates are advised to join them. It is said that the graduates, when compared with young men of the same age seeking the same employment, always receive higher wages at the commencement and are promoted more rapidly. In many cases the graduates are preferred over shop-trained apprentices. It is said that this is due, first, to the fact that they are at once of value to the employer, and, secondly, because the systematic preparation they receive in the school enables them to make more rapid advancement in practical work. It is possible in some cases for the graduates to work at their trades without undergoing a period of apprenticeship. As a rule, however, they start in as apprentices or helpers.

HIGHLAND FALLS TRADE SCHOOL, HIGHLAND FALLS, N. Y.

This school was established in Highland Falls, N. Y., in the fall of 1896. Primarily the school was intended as an inducement to the boys and young men of the town to spend their spare time during the long evenings in learning to do something practical and useful. By so doing it was thought that two commendable objects would be attained. First, the pupils would be kept from the streets after sundown and thrown in contact with elevating influences; and, second, they would be taught a good trade which they could follow for a livelihood.

Tuition is free. Applicants must be 12 years of age or over. The school opens the first week in October and closes the last week in May. Sessions are held six evenings each week from 7.30 to 9. The course of instruction covers a period of two years and includes elementary architectural drawing, which is designed to give a good knowledge of building construction and carpentry.

The school is managed by a trade-school committee, which is composed of prominent citizens. There is but 1 instructor, and his training was acquired in practical work. Owing to lack of adequate accommodations the number of pupils is limited to 12 in each class. During the year 1900–01 there were 24 pupils in the first and second

year classes in carpentry and 12 in architectural drawing. There have been 36 graduates. The building occupied by the school is a two-story frame structure worth about $1,000, and the equipment is valued at $250. The building and equipment were furnished and the school is maintained by a well-known society woman, who also maintains a free library for the use of the town. The cost of maintenance is $600 per annum. The officials state that the school needs additional equipment and more space. With these advantages the courses of training and study could be improved and the scope of the work extended so as to embrace other trades. Plans are being prepared for a larger building which will give ample facilities for all needed improvements.

It is stated that in most cases the graduates are able to engage in practical work without serving a period of apprenticeship, and that they are preferred over shop-trained workmen because their knowledge of drawing enables them to do better work and they are considered more reliable. Some of the graduates are in business for themselves and others are earning from $1.50 to $3 per day in the carpentry trade. The school has proved very satisfactory and has practically attained the end for which it was established.

NORTH END UNION TRADE SCHOOL, BOSTON, MASS.

The North End Union, of Boston, Mass., was started in 1892 as a continuation of the Hanover street chapel. It is under the Benevolent Fraternity of Churches, which was organized in 1834 and incorporated in 1839. This fraternity is composed of delegates from twelve Unitarian churches, who appoint visiting committees to three free churches, to the Parker Memorial, and to the North End Union.

The union is a social home for young people. It has clubs for boys and girls, gives instruction in many lines, and provides a free reading room, play rooms, public baths, and a Sunday school.

Its trade school is a combination of three schools, a school of plumbing, established in 1894, and said to be the first real trade school established in New England, a school of dressmaking, established in 1895, and a school of printing, established in 1900.

The starting of the schools or classes in the trades of plumbing and printing was primarily caused by the fact that there were so many boys without work and the realization that this was due to lack of skill and of the opportunity to acquire it. This would naturally have led to the taking into the schools of boys who had no experience in the trades, but for various reasons, some connected with the support received from the labor unions, it was determined to take as pupils only those who were already employed at the trade. The recognized inadequacy of the shop training was also the cause of the establishment of the school of dressmaking.

To be admitted to either the plumbing or printing schools pupils

must be already at work at their trade and at least 17 years of age, and to be admitted to the school of dressmaking pupils must be at least 18 years of age. Applicants for admission to the school of printing must have had at least six months' experience in the composing or press room of some printing establishment. The number of pupils at any one time are limited to, plumbing school 33; printing school 10, and dressmaking school 10.

Tuition fees are: Plumbing school, $10 for the full course; printing school, $10 per term of fifteen weeks, two evenings per week, and dressmaking school, for nine months' course, $25, or $3 per month for less than the full course, also $5 extra for the "dressmaking system."

The management of the school is in the hands of the superintendent of the union. There are 3 instructors of the trades taught, 1 being a a master or employing plumber, 1 an experienced dressmaker, and 1 a practical printer—a foreman in a printing office.

The number of pupils in these trade classes in the school year 1900 was: Plumbing, 33; printing, 8, and dressmaking, 3. There have been 34 pupils who have taken the full course in plumbing since the opening of the school, but none have as yet finished full courses in dressmaking or printing.

The value of that part of the North End Union building which is devoted to the teaching of these trades, together with its equipment, is about $3,000, and the annual cost of maintaining the trade courses is $600.

The funds for supporting these schools are raised from voluntary contributions and from the tuition and other fees paid by the pupils.

The courses of instruction are as follows:

Plumbing school: Fifty lessons in practical shopwork, as follows: Seams, overcast joints, cup joints, wiping horizontal round joints, wiping horizontal branch joints, wiping upright round joints, one-fourth bends, wiping upright branch joints, wiping a stopcock, wiping a flange on a 2-inch pipe, wiping a 2-inch ferrule, wiping a bath plug, wiping a vertical branch, wiping an upright flange, traps; also lectures on the science of plumbing.

On completion of the above course miscellaneous work is done, such as wiping 4-inch ferrules, making tank seams, wiping 2 and 3 inch joints, making service boxes, sand bends, and fancywork.

Printing school: No elementary work, such as teaching at the case, is undertaken. The plan of instruction includes book composition, job composition, and presswork (hand and job). Special attention is given to teaching the principles of punctuation, capitalization, etc. One of the objects of the school is to instruct pupils in details that are often overlooked in a printing office. Pupils are instructed individually, not as a class, thus affording an opportunity for advancement to those whose talents lead them in any special direction. From time to time evening talks before the school are given by men who have achieved success in the special branch of the trade.

Dressmaking school: Course in sewing. In connection with the course in sewing, talks are given upon the various materials used, with special reference to judicious purchasing. A collection of specimens of different kinds and qualities of materials used is arranged in the class room for the inspection of the pupils.

Pupils are required to record in notebooks, which are submitted for examination and correction, the instruction received at each lesson; and a written examination is given at the end of each term.

Applicants are required to pass an examination in simple sewing. This course is devoted to advanced sewing. Practice is given in all the various stitches upon small pieces of suitable material, which will be furnished by the school; other material must be provided by the pupil. The course of study is as follows:

Proper use of needles, thread, and thimble; position of body while sewing; method of weaving explained; basting and overhanding; turning hem by measure, hemming and running; stitching and overcasting; backstitching and felling; gathering, stroking gathers, and putting on bands; making buttonholes and eyelets; sewing on buttons; putting in gussets; talks on the nature and manufacture of cotton; herringbone stitch on flannel; patching; hemstitching, hemming and whipping ruffle; chain stitching, feather stitching, and mitering corners, french hem on damask; darning on scrim, stockinet, and cashmere; slip stitching and blind stitching; mending and darning.

The pupil will then furnish material for making a petticoat. She will be taught to use the sewing machine. Then follows: Taking measures; drafting, cutting and making undergarments; talks on white embroidery; cutting, basting, and making nightdress; cutting, fitting, and making underwaist from pattern; cutting and making dressing sack from pattern; matching stripes and figures; talks on the manufacture of lace; cutting, fitting, and making a cotton dress without lining, also shirt waist and skirt of cambric or gingham; a child's dress made from pattern, by hand and machine. Talks are also given on the different articles of household linen, and the proper method of making and caring for the same shown.

Dressmaking course: The pupil who intends to take up the study of dressmaking must have a fair knowledge of hand sewing and have made simple cotton dresses from pattern.

The course of study is as follows: Instruction in taking measures; cutting and making skirt from measure; cutting, basting, and finishing one-half of model waist; pressing taught; practice in taking measures and drafting waist patterns of different styles; drafting sleeves; cutting waist and sleeves from pattern drafted; finishing waist; instruction in color and textiles applied to dresses; instruction in choice of materials; cutting and matching striped or plaid waist and skirt; talk on manufacture of woolen dress goods; taking measures and drafting simple princess dress of cambric or gingham; planning fancy waist of silk or other material; cutting and making the same; talk on the manufacture of silk goods; the manufacture of cloth explained; drafting jackets of various styles; cutting, basting, fitting, and pressing; making of pockets and collars, lining and finishing.

A variety of materials will be shown and the pupil instructed in regard to texture, color, and suitability of each for various uses and for different types of wearers.

The talks on form treat of the most becoming manner of making a dress by adapting the lines of the material to those of the figure, and in selecting trimming suited to the material and the character of the figure. Dresses are planned to carry out these principles. Talks on remodeling garments, cleansing, etc., are given. Drawing lessons of three hours are given two afternoons each week. The course of study is made progressive and is carefully arranged to cover all important points, but it must be understood that the graduates of the trade school will have yet more to learn. Self-reliance, facility, and speed of execution must be acquired by practice in the trade itself.

With the time available, it is the opinion of the school officials that these trade courses could hardly be improved, though the school as a whole could be improved by being enlarged and by teaching more trades.

As to the plumbing course, the boy who takes it is often better fitted to do plumbing work than the boy who has served the regular apprenticeship to the trade for two or three years, for the former has actually handled tools, while the latter has only seen them handled. With more time to be devoted to this course it could be improved by giving more careful attention to the fundamental and scientific principles upon which the trade is based; that is, a more thorough training in the technical sciences, such as physics, sanitation, etc., would add greatly to the completeness of the course. The need in all trades is the broadest possible foundation in the sciences which underlie them, and in none of the courses taught in this school does such instruction go far enough. In this school the outlook for such improvement is fairly good, as many of those who are interested in trade schools are thinking along these lines.

The boys who have gone through the plumbing school have had better instruction than they could have received in the shops alone, they have succeeded in passing their examinations and obtaining their licenses as master and journeyman plumbers much more readily, and they have made better workmen. One young man successfully passed an examination for the position of plumbing inspector of the city before he had completed his course at the school.

These schools or courses have had a very beneficial effect upon those who have been under instruction therein, and as a rule steadier employment and more rapid promotion accrue to those who have taken the course, but in neither the plumbing nor the printing trade does the better preparation for work of the graduates result in higher wages for any special class of work, as under agreement with the unions wages are the same for all workmen of the same grade regardless of individual ability. For instance, the plumbers are divided into three classes—the helper, the plumber under instruction, and the journeyman plumber and there is one rate of wages agreed on for each class, all the individuals in any one class receiving the same rate. The graduate of the plumbing school gets good wages quicker than the nongraduate, because he gets out of the position of helper quicker and often enters into employment immediately upon graduation as a plumber under instruction.

Graduates of trade schools are undoubtedly preferred by employers to merely shop-trained workmen, because they make more intelligent workmen and are the only material out of which it is possible to make the competent foreman, superintendent, etc.

So far there are not enough trade schools or graduates of such schools to have had any effect toward improving the shop training in the locality. In fact, in the plumbing trade the effect of the school has been to injure rather than to improve shop training, because those master plumbers who have hitherto endeavored to do something to

help the learner along in spite of the opposition of the journeymen are now giving up the effort, which could not be more than partially successful, and are advising their helpers to attend the trade school.

The old-time apprenticeship system does not prevail, but in any trade where the unions control it is required that a new man or boy begin in a subordinate position and pass a certain definite time therein, no matter what his knowledge or capacity may be, and it is only in non-union shops that a graduate of a trade school can commence work as a journeyman mechanic or have his apprenticeship time shortened. The effect of instruction in the full trade-school course should reduce the period of apprenticeship at least one year, but it can not entirely do away with it. It does not teach the laying out of the work, and it can not teach the workman to meet emergencies successfully, to take the hazards of his work coolly, and to carry it on thoroughly and perfectly when in the presence of danger, as frequently must be done. Nothing but the actual experience of working at a trade will teach these things.

In a general way such trade schools as now exist in this locality are satisfactory as far as they go and are tending to attain the end for which established.

This school has had little effect upon the public and the business community, except that its proved merits are awakening sentiment in favor of trade schools and to the need of such facilities for education as the trade school gives.

MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION TRADE SCHOOL, BOSTON, MASS.

This school was opened October 29, 1900. Its object is twofold: First, to furnish a sufficient number of journeymen mechanics to fill the demand, and second, to give American boys an opportunity to learn a trade. It is under the management of the executive committee of the Massachusetts Charitable Mechanic Association.

The trades taught at present are bricklaying, carpentering, and plumbing. The work in these trades is managed by special committees, appointed by the government of the association, from its members engaged in actual business in the trades taught, who examine and select the candidates for admission, and at the completion of the course examine them, and graduate them if found qualified. Each graduate is given a certificate, certifying to his mechanical ability and recommending him to the favor of employers in his trade. These committees appoint instructors and manage all of the work.

Other trades than those now taught will be added from time to time as means permit. There are three instructors, all of practical training and now employed as foremen in the three trades taught. At present

a room in the building of the association is used for the school, and the equipment at the opening of the school had cost about $2,000. The funds were provided by appropriations from the treasury of the association, and the cost of maintaining the school will be defrayed from the same source and from the tuition fees.

The sessions of the school are held in the evening only, on Mondays, Wednesdays, and Fridays of each week. Tuition is $15 for the term, covering also the cost of tools and materials, payable $8 when a pupil is accepted and $7 on January 1.

Applicants must not be less than 17 years of age, able to read and write the English language, and must possess an elementary knowledge of the simple rules of arithmetic, fractions, and interest. They must be in good health, of good moral character, and each applicant must be vouched for by two reliable citizens.

It is not thought that the courses now existing can be substantially improved, but the school itself will be improved by the establishment of courses in other trades. This school is too young to determine the practical benefits resulting from its establishment. Generally speaking, the trade unions as such seem to be afraid of trade schools. They have manifested no opposition to this one, but are inclined to support it. The masons' and bricklayers' unions of Boston were formerly opposed in toto to trade schools, but are now favorably disposed to such as take only workingmen as pupils. What they believe in is a trade school, holding night sessions only, where the young man already at work at his trade may go and learn the theory and underlying principles of his trade and all the innumerable points which he can only pick up slowly, if at all, in actual work at the trade.

Schools of this kind, where they exist, are of great help to those under their instruction, and their graduates receive higher wages, obtain steadier employment, and get more rapid promotions. Many of them have been enabled to rise from the rank of mechanic and employee to that of master and employer. Graduates are always preferred by the employer to the merely shop-trained man, as they have greater intelligence and are more competent. There are no formally articled apprentices in these times, but all beginners must pass several years on low pay as learners, and the graduates of this school, when there are any, will probably be no exception to this rule, though it is expected that one result of this school training will be to somewhat shorten this period.

WILLIAMSON FREE SCHOOL OF MECHANICAL TRADES, PENNSYLVANIA.

A somewhat different type of school from any of the foregoing is the Williamson Free School of Mechanical Trades, founded by the late Isaiah V. Williamson, a merchant of Philadelphia, and located at

Williamson School, Delaware County, Pa., about 16 miles from Philadelphia. The course is considerably longer and much more academic work is required. The pupil during the course of three years is bound by articles of apprenticeship. In his endowment deed of trust, dated December 1, 1888, the founder states his motives and intentions:

I am convinced that the abandonment or disuse of the good old custom of apprenticeship to trades has resulted in many young men growing up in idleness, which leads to vice and crime and is fraught with great danger to society. For nearly thirty years I have carefully considered this subject, with the intention at the proper time of founding and endowing a free institution, to be located in the city of Philadelphia or its vicinity, where, subject to the control of proper managers and under the direction and supervision of skillful and expert instructors, poor and deserving boys could be gratuitously instructed in the rudiments of a good English education and, what is of equal, if not greater, importance, trained to habits of industry and economy and taught such mechanical trades or handicrafts as may be suited to their capacities, so that when they arrive at manhood they may be able to support themselves decently by the labor of their own hands and become useful and respected members of society, as I am well convinced that in this country any able-bodied young man of industrious and economical habits who has learned a good mechanical trade can not only earn a good living and acquire an independence, but also become a useful and respected citizen.

I request that the trustees shall at all times bear in mind the fact that the main object I have in view is to train young men to mechanical trades, so that they may earn their own living, and that while the acquisition of any branch of an English education which may be of aid to them in their several trades is necessary and important, any higher or advanced knowledge which might render them dissatisfied with or unfit for their employments is unnecessary and may be disadvantageous. I expressly direct that each and every scholar shall be compelled to learn and be thoroughly instructed in one good mechanical trade, so that when they leave the school on the completion of their indentures they may be able to support themselves by the labor of their own hands. I especially direct that the scholars shall be taught to speak the truth at all times, and that they shall be trained to habits of frugality, economy, and industry, as above all others the one great lesson which I desire to have impressed upon every scholar and inmate of the school is that in this country every able-bodied, healthy young man who has learned a good mechanical trade and is truthful, honest, frugal, temperate, and industrious is certain to succeed in life and to become a useful and respected member of society.

The par value of the securities transferred by the deed was $1,596,000, having an appraised value at the then market price of $2,119,250, and producing at that time an income approximating $100,000. A suitable site was selected, and the first buildings were completed and ready for occupancy on October 20, 1891.

The benefits of the school are entirely free, no charge being made for board, clothing, or instruction. Admission of pupils is made in April in each year. Applicants must not be under 16 nor over 18

years of age; they must be able-bodied, healthy, of good moral character, and possessed of natural aptitude and liking for mechanical work. The scholastic examination for admission includes reading, writing, spelling, arithmetic, including fractions, weights and measures, and interest, geography, United States history, composition and language. Other things being equal, preference in admission is made in the following order: Those born in the city of Philadelphia; those born in Bucks County, Pa.; those born in Montgomery and Delaware counties, Pa.; those born elsewhere in Pennsylvania; those born in New Jersey; those born elsewhere in the United States.

All pupils are bound as indentured apprentices to the trustees for the term of three years, with the provision that the indenture may be canceled at any time by the trustees for incompetency or bad conduct or if for any other reasons the trustees think the pupil unworthy of future and continued support and education. By the indenture the pupils are obligated to conform to all regulations and restrictions prescribed by the trustees or their representatives, and all right or claim to control them during the period they remain at the school is vested in the trustees.

Each pupil is given a preparatory course in woodworking and mechanical drawing in connection with studies in the schoolroom and extending through six months. At the end of that period pupils are placed at one of the following five trades, the selection of which is made by the trustees, due regard being given to the intention and adaptability of the pupils to the trades to which they are assigned:

Carpentering; pattern and cabinet making; bricklaying, including range, furnace, and boiler setting, etc.; machine trade in all its usual details; steam and electrical engineering, steam fitting, etc.

Each pupil takes but one of the trades named, and his instruction in mechanical and free-hand drawing tends in the general direction of his trade.

The branches taught in the academic department are reading, writing, arithmetic, algebra, geometry, physical and political geography, history, physical science, English literature, physiology and hygiene, civil government, chemistry, elementary vocal music, theory of the steam engine, strength of materials, and building construction.

The school and shops are in session eight hours daily on five days of the week and four hours on Saturday, each pupil spending about four hours in the class rooms and four hours in the shops daily the first year, the proportion spent in the shops gradually increasing toward the close of the apprenticeship.

The school term continues the entire year, but those pupils who merit it are given about two weeks vacation in summer and some days at Christmas.

The domestic life of the school conforms, as far as is practicable, to

good family government. To that end the pupils are divided into families of twenty-four, each having its matron and its own distinct home or cottage, cared for by its occupants. The homes contain no kitchens, dining rooms, or laundries, these being located in other buildings.

The trustees deem it to be quite as essential to have the pupils become good men as good mechanics, and special attention is given to their moral training. The school is nonsectarian, but each pupil, immediately after admission, is required to designate the religious denomination of his choice and thereafter attend its services regularly at its place of worship in the neighborhood.

The school is under the general management of a board of trustees. The faculty consists of a president, a superintendent, and ten instructors. The instructors in the mechanical department are practical workmen with expert knowledge of their respective trades. The number of pupils in each trade and grade during the past year was as follows:

PUPILS IN EACH COURSE AT WILLIAMSON FREE SCHOOL OF MECHANICAL TRADES.

Course.	Grade.			Total.
	First year.	Second year.	Third year.	
Carpentry	19	11	4	34
Pattern and cabinet making	17	15	6	38
Bricklaying, etc	21	7	5	33
Machine trade	29	19	12	60
Steam and electrical engineering, steam fitting, etc		8	1	9
Total	86	60	28	174

Since the school was opened there have been upward of 670 pupils in attendance, and of this number 328 have received certificates of graduation.

The school grounds cover an area of 200 acres. There are twenty-two buildings in all, most of them of very substantial construction of stone and brick. Exclusive of the teachers' residences, farm buildings, etc., the aggregate floor space devoted to the use of the several departments is about 85,000 square feet. The income of the school is derived solely from the endowment given by the founder. The par value of the invested funds is $1,657,096. The cost of maintenance is about $65,000 per annum.

The courses of training and study are based upon instructional methods. Regarding the merits of the system it is said that to become a successful mechanic a young man should be well grounded not only in the theory of his trade, but he should possess some knowledge of the physical sciences, mathematics, and mechanical drawing. As with the professions, so with the trades, a moderate practical experience is required to supplement the school training. The graduates must have

time to become accustomed to shop or trade ways before they can expect to attain proficiency. Referring to the benefits resulting from the establishment of the school, it is said that few of the graduates are employed in the vicinity of the school, as it is located in a country district. Most of them are employed in the leading manufacturing centers of the State, while a limited number have located in the Eastern, Western, and Southern States.

So far as it is possible to judge, the school has benefited both the graduates and their employers. The school has never been opposed by labor unions. At one time the Bricklayers' Union of Philadelphia gave its positive moral support to the graduates, and at present it is not unfriendly to them. The effect upon those who have been under instruction has been most gratifying, indeed. The training they received has resulted in bringing them higher wages and better positions than they would otherwise have obtained. There is a steady demand for the graduates by employers, and it is generally conceded that within a comparatively short time after graduation they become superior workmen. Some employers prefer the graduates because of their good general education and scientific knowledge of the basic principles of their trades. Their knowledge of mechanical drawing is always of great advantage to them. In most cases the graduates engage in practical work immediately after leaving the school, and they soon acquire a good standing as skilled workmen. Regarding the success of the school, it is said: "It is partly due to the care exercised in the selection of the pupils. The school can accommodate but one-fifth of those desiring admission, and only intelligent and deserving young men are taken." The officials are highly pleased with the results already accomplished, and they believe that training by a carefully graded instructional course in the basic principles of a trade is the best way to develop high-grade mechanics.

THE CALIFORNIA SCHOOL OF MECHANICAL ARTS, SAN FRANCISCO, CAL.

This school is the outcome of the generous public spirit of James Lick, a citizen of California. Having been brought up in narrow circumstances, earning his living in early manhood as a mechanic, he sympathized with the struggles of the young for a place in life, and resolved to found a school where those dependent upon themselves could receive such an education as would give them a foothold in the world.

On September 21, 1875, Mr. Lick executed a deed of trust by which he conveyed to certain trustees a large amount of property for various purposes of public benefit, of which this school was one. This trust provided for the founding and endowment, at a cost of $540,000, of an institution to be called The California School of Mechanical Arts,

the object of which should be to educate males and females in the practical arts of life, such as working in iron, wood, and stone, or any of the metals, and in whatever industry intelligent mechanical skill now is or can hereafter be applied. Such institution was to be open to all youths born in California. The trust named a board of trustees and provided for its perpetuation.

The execution of this particular portion of the trust was delayed by prolonged litigation, and it was not until January 3, 1895, that the buildings were completed and the school formally established. On Monday, January 14, 1895, instruction was commenced, with an enrollment of 99 boys and 33 girls. The first full class was graduated at the end of the school year 1897–98.

The school is open free of tuition to any boy or girl of the State of California who has completed the eighth grade of the grammar schools, upon the following conditions: Applicants are admitted upon satisfactory recommendation from their former teachers, principals, or school superintendents. Applications received after June 1 are not acted upon until July 15, and if the number of applications exceeds the number of places remaining competitive examinations are held to determine who shall enter. These examinations are written, and cover clear and correct expression in English sentences, arithmetic covering common and decimal fractions and square root, and leading facts in United States history and descriptive geography.

The hours of attendance are from 9 a. m. to 3.30 p. m. during the first two years of the course, and from 9 a. m. to 4.30 p. m. during the remaining two years.

In formulating a general plan of instruction the first thought was to comply with the broad and generous terms of the founder's bequest. At the time (1875) the deed of trust providing for the establishment of the school was executed the manual-training idea had not been developed in this country, and it is not probable that James Lick contemplated an institution the object and purpose of which should be restricted to giving to young men and young women simply the general culture and development that the ordinary course of manual training is understood to impart. It is equally certain that Mr. Lick had in mind a school and not merely a number of workshops. He provided for an institution to promote intelligent mechanical skill. To carry out the provisions of the endowment, as thus interpreted, a careful survey of the entire field of industrial education was made. Such features as could best be adapted to special needs and incorporated into a scheme of instruction, and which would accomplish the following specific results, were selected:

First. To give each student a thorough knowledge of the technique of some one industrial pursuit, from which he can earn a living.

Second. To see that his acquaintance with tools and materials, and with science and art, is broad enough to allow the fullest development in his special field and to permit of his ready adjustment to the new and varying conditions that are constantly taking place in all the mechanical and industrial arts.

Third. To develop in him a degree of intelligence that will prepare him for the duties of active citizenship.

It is the plan of the school to begin with a preliminary manual-training course, and when the student has nearly completed it to allow him to select one of thirteen mechanical and industrial arts, in order that he may devote to his chosen field of work his entire time for two years, making the full course four years in all. The preliminary course does not end abruptly at the end of the second year, but merges into the apprentice course for about six months. At the beginning of the third year any student who has completed the preliminary course satisfactorily may elect one of the trades or technical courses and pursue therein a formal apprenticeship for two years, leading to a diploma of graduation; or he is offered the privilege of attending the third year with a view to receiving a certificate for the completion of the preliminary course.

The courses of instruction are, therefore, arranged with an aim to solve the general problem of teaching trades to American boys as an integral part of their education and preparation for life. It is rather an ethic purpose, as compared with the guild schools of England and Germany, which are intended to meet the special industrial needs of the community in which they are located. A great variety of trades are included in these courses, besides one course designed as preparatory for a technical college course.

The opening of the Wilmerding School has been a decided benefit to the California School, because the latter had been compelled to extend its efforts over a very wide field of instruction in order to meet the needs of its large clientage. The Wilmerding School (see pp. 79 to 81) includes in its curriculum a long list of building trades, and as it is the policy of the California School to expand along the lines of machinery trades the field of building trades is left to the Wilmerding School. In accordance with this plan the apprentice courses in carpentering, wood carving, and industrial modeling have been discontinued, and students desiring these courses are instructed in the Wilmerding School. Students in the Wilmerding School who desire instruction along lines not provided for in that school are received and instructed in the California School. While the two schools are controlled by separate and distinct boards, and their maintenance is derived from entirely different sources, yet they are under the direct supervision of the same principal. It is therefore easy to adjust this interchange of work, and it has proved not only feasible but advantageous to both institutions.

The courses of instruction are as follows:

PRELIMINARY COURSE.

The preliminary course serves as a foundation for the different trades and technical courses. This part of the curriculum is essentially the same as the course given in the so-called manual-training schools. It is different for boys and girls as regards tool work and domestic branches, but otherwise it is the same for all students, and is required of all. It divides its time equally between academic and industrial branches.

The academic branches include English, mathematics, science, and history. One period of fifty minutes per day, for two years, is devoted to each of these subjects, with the exception of history, which is given on alternate days.

The instruction in English includes word study, grammar, and rhetoric, practice in written and oral expression, and a study of literature through English classics.

The mathematical instruction includes elementary algebra, plane, solid, and spherical geometry, and plane trigonometry.

The science work consists of physics (except sound and light) during the first year; chemistry during the second year; and physics (sound and light) during the first quarter of the third year.

The industrial branches are made up of the three elements: Tool work, free-hand and mechanical drawing, and household art and science.

The tool work is for boys only. During the first year it consists of a graded course of manual training woodwork, including instruction in the growth of woods and manufacture of lumber, sharpening saws and edge tools, elementary joinery, lathe work, notes and drawings of all work performed, foundry practice, and pattern making; forge work and molding during the second year; and during the first term of the third year machine-shop practice, including both bench work and lathe work.

The work in household art and science begins in the first year with a course of plain sewing and the preliminary parts of cutting and fitting. Drafting and dressmaking proper are completed during the first term of the second year. The rest of the second year is used for millinery. The third year's work of this department comprises cooking; a comprehensive course in the direct application of science and art in the household (including interior decorations and furnishings, heating, lighting, ventilating, and other sanitary conditions, and hygiene); and a course of chemistry (including chemistry of foods, sanitary chemistry, chemistry of cleaning, chemistry of dyestuffs, and use of microscope).

SYNOPSIS OF PRELIMINARY COURSE.

FIRST YEAR.

Course of study.	Number of weeks.	Periods per week.
Boys and girls.		
English	40	5
Mathematics (algebra)	40	5
Science (physics)	40	5
History (ancient) [a]	40	2½
Boys.		
General woodwork, molding, and pattern making	40	10
Free-hand and mechanical drawing	40	5
Girls.		
Sewing	40	7½
Free-hand and mechanical drawing	40	5

[a] Not given during 1899–1900.

SYNOPSIS OF PRELIMINARY COURSE—Concluded.

SECOND YEAR.

Course of study.	Number of weeks.	Periods per week.
Boys and girls.		
English	40	5
Mathematics (geometry)	40	5
Science (chemistry)	40	5
History (medieval and modern) [a]	40	2½
Boys.		
Forge work and molding	40	10
Free-hand and mechanical drawing	40	7½
Modeling or wood carving (optional).		
Girls.		
Dressmaking and millinery	40	7½
Free-hand and mechanical drawing	40	5
Modeling or wood carving (optional).		

THIRD YEAR.

Boys.		
Mathematics (logarithms and trigonometry)	10	5
Science (sound and light)	10	5
United States history and government	20	5
Machine shop	20 to 40	10
Girls.		
Science (sound and light)	10	5
German (elective)	40	5
Cookery	40	10
Household art and science; chemistry of cooking	40	5
Modeling or wood carving (optional).		

[a] Not given during 1899–1900.

The school has facilities for teaching the following trades and technical courses, from which each student is allowed to make a selection at the beginning of his third year: Pattern making; forge work; molding; machine-shop practice; machine drawing and ship drawing; industrial chemistry; industrial art; cookery; dressmaking; millinery; preparatory for technical college course.

Through these courses the school aims to give each student a thorough knowledge of the technique of some one industrial pursuit, from which he may earn his living. It offers, however, something more than the mere equivalent of a workshop apprenticeship.

Before commencing work exclusively at his trade, each student must first complete the preliminary course of woodwork and ironwork, including the elements of carpentry, pattern making, forging, molding, and iron fitting.

The shop instruction throughout is based upon work that is selected, as far as possible, for the benefit of the student, and not for the profit of his employer. Yet a reasonable proportion of each student's time is devoted to the manufacture of marketable goods, in order that he may be made to realize the conditions that he will have to face in after life. Before leaving the school he must be able to execute his work in such a manner and at such a rate that the product of his labor, if placed upon the market, will stand the test of competition.

About 75 per cent of the time of each apprentice course is devoted to technical instruction and the remaining time to supplementary instruction, as follows:

All apprentices are required to meet one hour per week, either in a body or in sections, for the purpose of discussing papers and reports to be submitted by individual members, somewhat after the seminary plan. The subjects of these reports are selected or assigned by the pupils themselves, as far as possible, and relate to manufacturing processes and devices, to topics from the history of art and industry,

and to scientific subjects. Each report must be exhaustive, and is placed before the class as clearly as possible by means of printed abstracts and the stereopticon, the presentation to be followed by a thorough discussion.

All apprentices are given a brief course in political economy, commercial geography, and the history and government of the United States.

The instruction in mathematics and science is different for different apprentice courses, as indicated under each course. Nearly all apprentices take one or more of the following: Theoretical mechanics; strength of materials, including laboratory practice and tests; determination of stresses in framed structures by graphical and analytical methods; heat calculations and phenomena of combustion, including a general study of transformations of energy, hydrostatics, laws of gases; simple boiler and engine tests, dynamo tests; metallurgy of iron; bookkeeping and business forms.

The free public library affords excellent opportunities for outside reading and study, and is well patronized by members of the school. In addition to a large and well-selected list of books on practical and technical subjects, it has also most of the leading scientific and technical periodicals.

APPRENTICE COURSE OF PATTERN MAKING.

Technical instruction: Continuous practice upon patterns for actual use in the foundry, including gear wheels, steam pumps, steam engines, hoists, propeller blades, dynamo frames, core work, and sweep work; model making.

Supplementary instruction: Study of advanced foundry work; methods of manufacturing, preserving, and seasoning lumber; shop arrangement and management; woodworking machinery and mill methods; methods of storing and checking patterns; mechanical drawing; science and mathematics.

APPRENTICE COURSE OF FORGE WORK.

Technical instruction: Continuous practice in forging difficult machine parts, such as engine shafts, connecting rods, and other parts; accessories for hoists; cranes; forge tools; lathe tools; carriage and wagon parts, etc. Also structural and ornamental ironwork, and sundry selected jobs covering the entire field of forging.

Supplementary instruction: Estimates, contracts, and specifications; properties, sources, and prices of materials used; metallurgy of iron; production of steel; manufacture of rolled-steel shapes, and their uses; science and mathematics; Saturday excursions to ironworking establishments.

APPRENTICE COURSE OF MOLDING.

Technical instruction: Standard foundry practice in all its details. The articles of machinery manufactured at the school are both numerous and varied, requiring many castings in iron, brass, and other metals, and affording ample exercises in molding.

Practice is also had in casting bronze figures, in piece molding, molding in gelatine, wax, and sulphur, and by the last wax process for undercut work, core work, sweep work, care of cupola, etc.

Supplementary instruction: Estimates, contracts, and specifications; metallurgy of iron; science and mathematics; Saturday excursions to ironworking establishments.

APPRENTICE COURSE IN MACHINE SHOP.

Technical instruction: Machine-shop practice in all its details, requiring work at the vise, and including the use of the lathe, planer, shaper, milling machine, drill press, etc.; construction of engines, hoists, lathes, pumps, gas engines, etc.; electrical construction—dynamos, motors, hoists, heating and lighting appliances, etc.; care of power plant.

Supplementary instruction: Estimates, contracts, and specifications; prices, sources, and properties of materials used; metallurgy of iron and production of steel; science and mathematics; Saturday excursions to ironworking establishments.

APPRENTICE COURSE OF MECHANICAL DRAWING.

Technical instruction: Machine drawing—drawing familiar machine parts to scale; design of gear teeth with application to rack and pinion, spur, bevel, worm, and helical gears; sketching to measurement a machine involving gearing, and making the complete working drawings for shop use; drawing and detailing pumps, compressors, hoists, water wheels, oil burners, gas and oil engines, electric motors and dynamos; boiler settings, and auxiliary connections for complete steam plant; use of rolled steel forms and calculations of columns, beams, and shafts; a study of valve diagrams; engine and boiler design—land and marine; the design of engine valves, link motions, governors, and fly wheels; a study of the types of engines and boilers.

SHIP DRAWING.

In this course the lines of a ship's body, the midship section, inboard and outboard profiles, are drawn to a suitable scale, and a wooden model is made in order to give the student a clear conception of the actual form represented by his lines. The stability, carrying capacity, and displacement in tons are calculated from the drawings. Practice is given in the use of the rules of the classification societies, such as Lloyds, Bureau Veritas, and the American Bureau of Shipping. Practical points of ship construction are dealt with and the apprentice is given as much familiarity as possible with shipyard methods. Tracing and blue printing throughout the course.

Supplementary instruction: Estimates, contracts, and specifications; metallurgy of iron and the production of steel; science and mathematics; Saturday excursions.

APPRENTICE COURSE OF INDUSTRIAL CHEMISTRY.

This course is intended to meet the demand for workmen skilled in the use of chemical tools and appliances. It is not in any sense the equivalent of a college course of chemistry for the education of scientific investigators. It aims to give the student a thorough knowledge of chemistry as applied to industries based upon chemical principles. The course includes qualitative and quantitative analysis, applying the same to the analysis of sugars, wines, soaps, acids, paints, fertilizers, and other commercial products and by-products.

Supplementary instruction: Science and mathematics; Saturday excursions.

TECHNICAL COURSE OF INDUSTRIAL ART.

This course is necessarily restricted by the lack of facilities at the school for executing designs for oilcloths, fabrics, stained glass, wall paper, mural decorations, etc., but this defect is corrected as far as possible by frequent visits to factories and by inquiries among manufacturers. Since the school itself has facilities for executing designs in wood, clay, terra cotta, and iron, the fundamental principles are especially applied to work done in those materials. In addition to the elementary principles of perspective light and shade, color, etc., studied during the preliminary course, the following topics will suggest the field of work in this course: History of art; drawings of the five orders; anatomy; plant analysis; copying of ornaments from casts, photographs, and natural objects; laws of composition and their application; designs for furniture, ornamental iron, pottery, etc.; excursions to museums, art exhibitions, etc.; chemistry of materials used—their properties, preparation, etc.

TECHNICAL COURSE OF COOKERY.

A continuation of the third year's course of cooking from a more scientific standpoint; more advanced processes, as canning, preserving, pickling, desserts, ice creams, etc; cooking for invalids; physiological considerations and nutritive values; preparation of menus; table decorations.

TECHNICAL COURSE OF DRESSMAKING.

Designing and manufacture of tea gowns, princess dresses, tailor-finished suits, jackets, children's garments, etc; history of costume; study of drapery; sketching; hygienic principles; methods of manufacturing threads, cloths, and other materials used; excursions to manufactories.

TECHNICAL COURSE OF MILLINERY.

Covered hats and bonnets, crepe bonnets, shirred and velvet hats, etc.; manufacture of frames and braids; trimming with choice materials; history of costume; sketching; methods of manufacturing materials used.

PREPARATORY FOR TECHNICAL COLLEGE COURSE.

Graduates from this course are prepared to enter the universities in the courses of civil, mechanical, electrical, and mining engineering. They are admitted to the engineering colleges of the University of California without examination.

The school is under the control of a self-perpetuating board of trustees originally named by the founder.

The faculty consists of 15 instructors. In the academic department all of the instructors are college graduates. The shop instructors are men who were holding responsible positions—foremen as a rule—in large manufactories when selected for positions in the school; they are all thorough masters of their respective trades.

The total enrollment for both sexes in all grades since the opening of the institution, including the school year ending in 1902, has been 2,301. The enrollment for the single year 1901–02 was 372, distributed as shown below:

PUPILS ENROLLED AT THE CALIFORNIA SCHOOL OF MECHANICAL ARTS, 1901–02.

	First preliminary.	Second preliminary.	Junior apprentice.	Senior apprentice.	Ungraded.	Visitors.	Total.
Boys	99	38	32	20	85	10	284
Girls	33	16	14	6	18	1	88
Total	132	54	46	26	103	11	372

Students who enter from other secondary schools receive credit for any part of the curriculum of this school which they may have completed; such students usually follow a mixed programme of studies, filling out the balance of the regular course, and are designated as "ungraded." A few mature students—normal-school graduates, etc.—have been admitted for a few weeks or a few months at a time, and are designated as "visitors."

Up to and including the school year ending in 1902, the school had given diplomas of graduation to 163 students, distributed as follows: Pattern making 15, forge work 3, machine shop 35, machine drawing 12, architectural drawing 15, technical industrial art 6, technical modeling 2, technical dressmaking and millinery 22, technical course preparatory to college technical course 46, industrial chemistry 5, and in both pattern making and machine shop 2. In addition, certificates for completion of the preliminary course were granted to 41.

There are two main buildings—the academic building and the shops. Both are built of stock brick, with artificial stone trimmings. The academic building is 71 by 123 feet and three stories high. This building contains recitation rooms, physical and chemical laboratories, and the domestic department. The shop building consists of a two-story portion 40 by 107 feet, and a one-story portion 50 by 155 feet, besides an additional cupola shed 10 by 13 feet. There is also a third building of corrugated iron over wooden structure, which surrounds the brass furnaces, core oven, and terra cotta kiln.

The school is supported by the income from its original endowment. For the year ending June 30, 1900, the earnings of the endowment fund were $26,638.28, and the disbursements from these earnings for the same period were $26,232.27. Of the disbursements $18,747.11 went to pay salaries and other current expenses and $7,485.16 went for taxes. In November, 1900, the State constitution was amended by a vote of the people so as to exempt the property of the school from taxation. Besides the amount received from the endowment fund, each student pays $10 per year to cover expenses of materials, and a small revenue, about $2,500 per year, is derived from the sale of articles manufactured in the school.

When the school was opened in 1895, it was expected that many desirable changes would suggest themselves as the work progressed, but experience has shown the original plans to be successful beyond expectation. There has been no trouble in finding an abundance of commercial work for the school shops, without interfering with local manufacturers. The school is flooded with applicants and it can not now accommodate more than half or two-thirds of those applying.

One very important and interesting question has arisen concerning the length of time given to the preliminary course, which all students are required to complete before commencing their apprenticeships. This preliminary training covers two years in this school, but it has been so modified as to allow credits for such subjects as students may have mastered in manual-training schools, thus reducing the time in some instances to six months. In some other schools of this character the preliminary training extends over only six months or a year. While the two-year preliminary work has given, on the whole, excellent results, the management does not claim that it is the best.

The graduates of the school have been before the public too short a time to allow conclusions to be reached as to any general or specific influence they have exerted upon the industries of the community. Labor unions have not formally expressed their recognition of the school, but there is evidence of their good will.

The graduates of the school are accepted by local manufacturers as fourth-year apprentices, or "improvers," and at the end of one year they are rated as full-fledged journeymen. Employers seem to prefer that the school give an additional rating and recommendation to each

graduate, rather than to attempt to lay down any general rating for all. Under this arrangement some of the graduates receive journeymen's pay from the beginning, while others still are rated as journeymen, but work for a time at slightly lower wages than are allowed journeymen.

Local manufacturers, while properly looking after their own interests in the matter, have at the same time shown a thorough appreciation of the qualifications of the school graduates. Reports received from employers are very gratifying. They speak in terms of the highest commendation of pupils in their employ, and are constantly asking for "more like them." Positions are assured to all the graduates the school can turn out. In the matter of workmanship they are commended for both the thoroughness and completeness of their training. They are not only thoughtful, painstaking, self-reliant, and conscientious, but their efficiency is also increased by their high standard of general intelligence. They have also won favor from their employers because of their good habits and gentlemanly bearing.

The results of the work of this school might be summed up in the following conclusions:

1. It is feasible to teach trades (certain fundamental ones) to American boys as an integral part of their education and preparation for life.

2. Such a school can be perfectly articulated with the grammar school. In other words, it can rank as a strictly secondary school in grade, and be vocationary in character.

3. Besides the advantages enumerated in the course of instruction, there is another important consideration which necessitates a broader, more thorough, and more varied training for students in institutions of this kind than is ordinarily given to shop apprentices. In a large manufactory it is to the interest of the employer to find out what the apprentice can do most handily, and to keep him at such work. In other words, to restrict his instruction to a more or less narrow field. The trade school, on the other hand, can not anticipate exactly the position that will be open to any given graduate, and hence must give him a training which will fortify him against any emergency and enable him to meet the special needs of any position likely to be open to him after graduation. In this way the school has the advantage of exerting a broadening influence, as against a narrowing tendency likely to prevail in the ordinary shop apprenticeship.

THE WILMERDING SCHOOL OF INDUSTRIAL ARTS, SAN FRANCISCO, CAL.

The object of the Wilmerding School is to teach trades to boys. It was established through the generosity of the late J. C. Wilmerding. Mr. Wilmerding bequeathed to the regents of the University of California, the sum of $400,000 "to establish and maintain a school, to

be called 'The Wilmerding School of Industrial Arts,' to teach boys trades, fitting them to make a living with their hands, with little study and plenty of work."

In October, 1897, the board of regents actively began to carry out the provisions of their trust, and in 1899 the present building was erected and equipped. The building is a wooden structure and cost $20,000, the necessary ground cost $23,000, and the equipment cost $16,000. The citizens of San Francisco, wishing that as little as possible of the original fund should be expended for a site contributed $20,000 toward purchasing the necessary ground for the school. The present building is 60 by 160 feet and two stories high. It is substantial and convenient, but only temporary in design. A permanent structure is now (1901) being built by the students.

While the trust establishing the school is entirely independent of that providing for the California School of Mechanical Arts, yet both schools are under the direct supervision of the same principal. They are situated on adjacent lots and pupils in one school can go into the shops of the other when it is to their advantage to do so.

The courses of study and instruction are arranged with a view of carrying out the wishes of the founder, and cover the building trades, such as carpentry, cabinet making, bricklaying, blacksmithing, plumbing, wood carving, clay modeling, and architecture. While the main work of the school is manual training in these trades, the pupil receives also the drawing and mathematics required by a first-class workman, such training in English and business forms as will enable him to transact his business properly, such portions of geography and history as are most intimately associated with the development of mechanical arts, and such knowledge of the history and principles of our Government as a good citizen should possess. In short, it is intended that the graduates of the school shall be well-instructed workmen in the trades which they select, and intelligent citizens. The equipment of tools, machinery, and appliances is very complete. All the shops are equipped with the best of everything in this line and arranged according to the latest shop methods. The course is designed to cover four years. There is no charge for tuition, the use of tools, instruments, or materials. Any boy who has graduated from the eighth grade of a grammar school will be admitted to any department of this school. Boys who have finished only the seventh grade will also be admitted, provided they are over 16 years of age.

The school in 1901 had enrolled but two classes, together numbering 165. The faculty consists of 12 instructors. Those in the academic departments are all college graduates, and the shop instructors are men who are thorough masters of their respective trades. The annual cost of maintenance is $21,500, and is provided from the earnings of the original endowment. The school has not been in existence long enough to send out a class of graduates, and therefore no

results as to the standing of its students with the manufacturing world can be given. The school is well equipped and its work is laid out upon lines that suggest a reasonable hope for gratifying results.

HEBREW TECHNICAL INSTITUTE, NEW YORK, N. Y.

The need for a school of this particular kind arose from the fact that the large influx into New York City of Jewish immigrants, for the most part in straitened circumstances, resulted in a heavy strain on the Jewish charitable organizations. It was recognized that in many instances permanent relief for the older immigrants was hopeless, and that sure relief could come only through the proper training of the children. In other words, the founders of the institute felt that the best and most practicable way to help the poorer class of Hebrews was to give the younger members such education as would fit them for success in mechanical trades, and thereby place them in a position to support themselves and those dependent upon them. With this purpose in view, the Hebrew Technical Institute was established in New York City in November, 1883. The buildings occupied by the institute are located at Nos. 34 and 36 Stuyvesant street and Nos. 225 and 227 East Ninth street. The school occupies a portion of the Ninth Street building, erected in 1892, and the whole of the adjacent Stuyvesant Street building, which was erected in 1896 as a thoroughly modern school building.

The annual catalogue states that the institute partakes of the nature of a manual training school, a trade school, and a polytechnic school, without belonging distinctively to any one of these classes.

Though founded and supported by those who are convinced of the worth and dignity of manual labor, and who are desirous of opening to Jewish youth the life of usefulness which awaits the skillful and conscientious mechanic, the institute must, nevertheless, take into account the fact that its pupils are deprived of the advantages of hereditary experience in choosing the exact trade which they are to follow. Apprenticed to a single trade, they might not develop that particular aptitude necessary to success, while the transfer to another and more suitable branch might be hindered by a lack of general manual and intellectual training. Boys are therefore received at an early age and instructed during the first two years in those subjects which will be useful to them in whatever mechanical pursuits they may finally follow. In the third year they are encouraged to give special attention to that particular branch of work which seems most suitable for each, and which they can follow for a livelihood after leaving the school. In this the aim is at thoroughness, dexterity, and understanding in general, rather than at the acquirement of those special manipulations which can be rapidly acquired in practical work if the foundations have been properly laid.

While receiving a thorough technical training, the students are not allowed to neglect that general education which is required in the public schools. A part of the daily work is therefore given up to the essentials of a good English education. The school contains a reference library, consisting chiefly of books on mechanical and scientific subjects, and there is also a circulating library, containing books of travel, history, poetry, fiction, mechanics, and science.

Candidates for admission must be of Jewish faith, residents of New York City, at least 12½ years of age, healthy and strong, and must present satisfactory testimonials of scholarship and character. They must pass a satisfactory examination in arithmetic through denominate numbers, English, geography, and United States history. They must also be examined by the medical adviser in regard to their general health and strength.

Boys who have already done all of the work of the junior or the middle class will be admitted to advanced standing.

Tuition, books, and tools are furnished free. Warm lunches are provided at a charge of 1 cent per day, or 5 cents per week. Shower baths are furnished free, and bathing forms a regular part of the school exercises.

The full course requires three years for completion. No pupil will receive a diploma from the institute unless he shall have satisfactorily completed all of the work required for the full course in each of the several departments.

The daily session of the institute begins at 9 a. m. and closes at 4 p. m., Mondays, Tuesdays, Wednesdays, and Thursdays; at 4 p. m., Fridays. The junior class is always dismissed at 4 p. m. There is a recess of one hour at noon.

In July, August, and a part of September there are only half-day sessions, from 9 a. m. to 12 m. There is no session on Saturdays, Sundays, Jewish holidays and legal holidays. The school is closed during the first two weeks of July and the first two weeks of August.

The regular course of instruction embraces elementary and advanced studies in English, mathematics, mechanical and free-hand drawing, applied science, including physics, chemistry, electricity, etc., and shop work in wood and metal. In addition to the regular work of the third year, each pupil is obliged to adopt one of the following courses as a specialty:

Mechanical drawing (two hours per day): Parallel and angular perspective; architectural drawing; foundations; piers and walls; floors, roofs, and stairways; structural ironwork; round writing; artistic lettering; tinting.

Machine drawing—isometrical and cabinet projection; wheel gearing; belt settings; details of steam engine and dynamo; details of [illegible]; assembled drawings.

Wood working (two hours per day): Advanced pattern making at the bench and lathe; molding and casting in lead; carpentry work; cabinetwork; wood carving.

Metal working (two hours per day): Machine work—building some machine or apparatus, as speed lathe, dynamo, or galvanometer; thread cutting, inside and outside; use of milling machine; reaming and boring; making taps, chucks, and face plates; gear cutting; tool making.

Tempering and grinding tools; diesinking; forging.

Practical electricity (two hours per day): Lectures and recitations, two hours per week.

Experimental work—electro-magnetism; primary and storage batteries; dynamos and motors; electrical measuring with amperemeter; voltmeter and Wheatstone bridge; electrical testing of dynamos, motors, and arc lamps; construction of apparatus for use in demonstrations and experiments.

The institute is controlled by a board of directors, partly elected by the Institute Society and partly delegated by the Hebrew Benevolent and Orphan Asylum Society, of New York City. The educational work is supervised by a subcommittee of the board of directors.

There are 11 instructors, of whom 5 are college graduates, 1 a graduate of a technical school, and the others are men who have acquired a practical training in the several trades. The number of pupils in the different classes during the past year was as follows: Junior class, 91; middle class, 48; senior class, 41. The number of graduates is comparatively small, only 375 pupils having completed the full course. The land, buildings, and equipment are valued at $132,000, and the annual expense of maintenance is about $20,000. The funds for building and equipping the school were provided by voluntary contributions from members of the Jewish community, and it is supported by the annual dues and contributions of members, voluntary contributions of nonmembers, legacies of deceased members and nonmembers, and by the proceeds of occasional benefit entertainments.

In the opinion of the officials, the courses of training and study could be improved by the employment, in some instances, of more experienced teachers, by having better and more complete equipment, and by an increase in the space devoted to class work. Owing to lack of funds, the outlook for improvements is not promising.

The number of graduates form such a small proportion of the total number employed, it is impossible to trace such benefits as may have accrued to the industries of the locality as a result of the establishment of the institute. It is thought that in a general way the institute has contributed its quota toward increasing the intelligence of the working classes and in promoting industrial, educational, and social development in the community. The institute is opposed by one of the local labor unions, which represents a branch of the woodworking trade, on the ground that it is turning out too many young men who enter that trade. This opposition is evidently without foundation, as the records of the school show that during the past fourteen years there have been only seventeen graduates who have taken up woodworking trades. Regarding the effect upon those who have been under

instruction, experience shows that the graduates in a short time can earn more and advance more rapidly than can boys who have passed through years of regular apprenticeship in a particular trade, while their opportunities for general development have, meanwhile, been far greater. The last report from the graduates shows that the average wages of 31 members of the class of 1899 amounted to $5.30 per week during the first year after leaving school, and from this amount there is a gradual increase in the earning capacity of each class with the lapse of time. The class of 1893 report 22 members who averaged $17.75 per week, and 10 members of the class of 1886 report having averaged $26.50 per week during the year 1900.

It is the strong belief of the officials that but for the training received by these graduates they could not have made such material progress. In fact, without that training they could not have occupied the positions which many of them have held since leaving the school. At the present time not one of the graduates is known to be out of employment. The institute has many and constant requests from manufacturers for graduates. It is thought that this is a good indication that the graduates are preferred over shop-trained apprentices.

None of the graduates take up regular trade work without undergoing a period of apprenticeship. The institute does not profess to teach trades with that degree of thoroughness that will fit the graduates to take up the work of journeymen, on the contrary, it only aims to give such a knowledge and training in the fundamental principles as will enable the graduates to enter the trades either as apprentices or helpers and make rapid progress thereafter.

The officials feel that the institute has proved eminently satisfactory and has fully attained the end for which it was established.

BOSTON ASYLUM AND FARM SCHOOL, BOSTON, MASS.

This school was founded in 1814 for the purpose of training orphaned boys of deserving character to earn a livelihood. It was located in the historic old house of Sir William Phipps, on the corner of Salem and Charter streets, in Boston, where it remained until 1832, when Thompsons Island, in Boston Harbor, was purchased for the school, and there it has been located to the present day. This school is a private institution, and has no connection with the city of Boston, as might be inferred from its name, except that it is situated within the city limits. Thompsons Island has an area of 157 acres. It is 3 miles from the foot of State street and 1⅛ miles from City Point, Boston.

This school is conducted by a board of managers and is under the immediate management of a superintendent. It receives boys between the ages of 10 and 14 years, furnishes them with a comfortable home, affords them a grammar-school education, and teaches them to work, so that when old enough to go out into the world they are prepared to

meet and grapple with the problems which life will present. All the boys attend school one-half the day, and during the other half work at the various trades and occupations that are taught.

At the age of 15 or 16 the boys are expected to have completed the course of study, and under certain circumstances they then return to their relatives or friends. If this is not the case, positions are found for them to work at the trades or occupations they have learned, or homes are found for them on farms in the country. A careful supervision is kept over each boy until he is of age. He is visited at frequent intervals, advised in person and by letter, and an effort is made to have each boy earn and save as much money as possible. When a boy is admitted to the school a form of relinquishment must be made out by his guardian or surviving parent, giving him up to the school entirely during his legal minority.

Careful attention is paid to the deportment of the pupils at all times and to their religious instruction. Plenty of recreation is allowed, and sports are encouraged. In summer the bathing is unsurpassed, and baseball and football clubs exist, and are supplied with uniforms and all the required paraphernalia. In winter there is excellent skating, coasting, and tobogganing. There is also a large and well-equipped gymnasium. A large library of carefully selected books is maintained.

In addition to its academic course of instruction, the school has regular courses for the teaching of carpentry, blacksmithing, printing, farming, marine engineering, music (for the training of band musicians), and piloting (training of pilots).

In addition to the above, industrial training is given some of the boys in the school bakery, laundry, and kitchen (cooking, etc.), and in its so-called "Cottage Row" the school has a feature much like the "Junior Republic," a city with its mayor and other officers, a bank, etc., and the boys are trained in the conduct of municipal affairs, banking, buying and selling real estate, stocks, etc.

The instructors in this school have had a normal or technical training. During the year ending in 1900, 45 pupils were engaged in studying carpentry, 6 blacksmithing, 6 printing, and 30 farming; on the steamer there were 6 engaged in studying marine engineering and piloting, and in the school band there were 22. From the establishment of the school 1,752 had been graduated in one occupation or another up to the year 1900. Many of the graduates have become prominent in business, in politics, or in the social world. They are to be found in all walks of life; one for fifteen years has been harbor master, another is a chief of police, others are doctors, lawyers, ministers, manufacturers, postmasters, librarians, musicians, superintendents, foremen, overseers, pilots, engineers, mechanics, and farmers.

On January 1, 1900, there were in the school 98 pupils, the smallest number during the year. The largest number at any one time was 102 and the whole number present during the year was 121. The average age of the boys admitted was 11 years 8 months and 2 days. The average age of boys discharged was 15 years 7 months and 3 days.

Of the boys discharged and relocated 6 returned to parents or guardians and 17 were added to the "out family" of the school. Of the latter number, 16 were employed as follows: 1 as a blacksmith, 8 on farms, 2 as machinists, 2 as office assistants, 1 in a factory, 1 in a market, and 1 as a roofer.

The present buildings of the school cost about $50,000. The main building was erected in 1852, but has been added to since. The barns were built in 1864 and the industrial building was built in 1885.

The annual expense of maintaining the school averages about $20,000. The funds for this purpose come from invested funds, sales from the farm, amount paid by Boston board of overseers of the poor for board of city orphans at school, donations, etc.

The courses of instruction could hardly be improved except as regards the farm. There the beginning of a grammar school course in farming would be an improvement, and such a course is being developed.

Labor organizations have never paid any attention to this school so far as is known. This school has well equipped its graduates for employment and they are in great demand by employers, who prefer them to merely shop-trained boys, as they have learned to work steadily, obey promptly, and attend strictly to the work they are on. For these graduates higher wages, steadier employment, and more rapid promotion has been the rule, and those who have taken the courses in marine engineering, farming, and printing are able to begin work at their trades without undergoing a period of apprenticeship. This school has in a general way proved satisfactory and has long ago attained the end for which it was established.

MILLER MANUAL-LABOR SCHOOL OF ALBEMARLE, CROZET, VA.

This institution was established by an act of the legislature of Virginia approved February 24, 1874, designed to carry into effect the will of Samuel Miller. The will, after making numerous legacies, provided that the residue of the estate should be used for the benefit of the county of Albemarle by the "founding, establishment, and perpetual support of a school on the manual-labor principle." The formation of a corporation was provided for consisting of the members of the State board of education and their successors in office and the second auditor of the State and his successor in office, to be known as the Miller Manual-Labor School of Albemarle. To this corporation

the executor of the will of Samuel Miller turned over stocks and bonds amounting to over $1,000,000.

In October, 1878, the school opened at Crozet, Va., with 20 pupils. Under the terms of the bequest instruction in the school, free of expenses, was open to "as many poor orphan children, and other white children whose parents are unable to educate them (such orphans and other children to be residents of the county of Albemarle), as the profits and income of the funds herein devised and bequeathed will admit of." The school was started with boys only, but in November, 1884, girls were for the first time admitted. The school is both academic and industrial in character, numerous trades being taught.

The school trustees of the county of Albemarle and of the city of Charlottesville meet in January and July of each year. At these meetings those children who come under the requirements of Mr. Miller's will are selected and designated, and from their number the county court appoints the pupils of the school. They must be residents of Albemarle County and must be between 10 and 14 years of age, though exceptions may be made in favor of children over 14 years of age whenever special benefits will thereby be conferred.

The school is managed and controlled through the agency of the county court of Albemarle County. The court appoints annually two intelligent, respectable, and well-educated gentlemen, whose duty it is to select and employ, whenever necessary, competent and suitable teachers for the school, subject to the approval of the county court. There is also a superintendent, a director of the department of practical mechanics, a bookkeeper, a chaplain, a resident physician, a matron, a librarian, and a secretary, with a full corps of teachers and instructors, all concerned in the management of the school.

The courses taught are woodworking, including carpentry, cabinet-making, etc., machine-shop work, foundry work, forge work, printing, steam and electrical plants, free-hand drawing, mechanical drawing, painting, plumbing, dressmaking, sewing, and cooking.

For the year 1900-1901 there was a total of 49 officers, teachers, and instructors in the school, of whom 19 were employed in teaching the industrial courses. Of the latter 3 were trained in colleges and by teaching, 1 in an academy and by teaching, 2 in public schools and by teaching, and the remainder were either graduates of the Miller school or practical workmen. In this year there were 40 pupils in wood working, 24 in the machine shop, 24 in the foundry, 24 in the forge shop, 3 in printing, 3 in the steam and electric plant, 35 in dress-making, sewing, etc., and 48 in cooking. The number taking the courses of free-hand and mechanical drawing was not obtained, and there appear to be no pupils in the courses of plumbing and painting.

Since the establishment of the school there have been 70 actual graduates. The majority of the pupils have left school before graduation.

There are 611 boys who have gone out from the school, and their present status (1901) is as follows:

OCCUPATIONS OF BOYS WHO HAVE GONE OUT FROM THE MILLER SCHOOL.

Occupations.	Number.	Occupations.	Number.	Occupations	Number.
Agent, baggage (R. R.)	1	Foundry men	6	Plumbers	4
Agents:		Gardener	1	Postmasters	2
Station (R. R.)	2	Hammer smith	1	Potter	1
Insurance	3	Hostler	1	Preacher	1
Bakers	2	Inspectors:		Printers	3
Blacksmiths	3	Car (R. R.)	1	Professors in colleges	7
Bookkeepers	3	Locomotive (R. R.)	2	Property man, theater	1
Brakemen (R. R.)	2	Instructors:		Railroad employees, miscellaneous	6
Bricklayers	7	Drawing	2	Sailor	1
Broker, commission	1	Engineering	2	Salesmen, traveling	3
Cabinetmakers	17	Forge and foundry	4	Sheriff, deputy	1
Carpenters	8	Language and literature	1	Shoemaker	1
Carpenters, bridge (R. R.)	2	Machine shop	3	Soldiers	2
Chemists	2	Manual training	3	Stenographer	1
Clerks	27	Physics and mathematics	2	Steward, hotel	1
Clerk, Railway Mail Service	1	Public school	4	Stonecutters	2
Conductors:		Woodworking	1	Students	15
Railroad	2	Inventor	1	Superintendent:	
Street car	3	Journalist	1	Railroads	1
Constable	1	Lawyers	3	Water supply, (R. R.)	1
Contractors:		Machinists	44	Supervisor of bridges (R. R.)	1
Brick	1	Mail carrier	1	Telegraph operators (R. R.)	8
Railroad	1	Managers:		Town sergeant	1
Draftsmen	8	Furnace	1	Train dispatchers (R. R.)	3
Electricians	6	Restaurant	1	Turners, wood	2
Engineers:		Manufacturer	1	Upholsterer	1
Civil	1	Master of transportation (R. R.)	1	Miscellaneous	145
Electrical and mechanical	3	Merchants	9	Total	492
Locomotive (R. R.)	1	Motorman, street car	1		
Stationary	2	Newsboys	2		
Farmers	36	Nurseryman	1		
Firemen:		Overseer	1	Unknown	59
Locomotive (R. R.)	1	Painters	4	Blind	1
Stationary	4	Pharmacists	5	Paralyzed	1
Fitters, shipyard	2	Photo-engraver	1	Insane	1
Florists	2	Physicians	4	Dead	57
Foremen, shop	6				

Of these boys 35 have attended higher institutions of learning. The average annual income of the entire number (not including dead, unknown, etc.) is $594. Of the graduates the average annual income is $1,000, and of the nongraduates $533.

The status of 166 girls who have left the school is as follows:

OCCUPATIONS OF GIRLS WHO HAVE GONE OUT FROM THE MILLER SCHOOL.

Occupations.	Number.	Occupations.	Number.
Artist	1	Teachers	16
Bookkeeper	1	Trained nurse	1
Clerks	5	Miscellaneous	21
Companion	1	Total	57
Dressmakers	4		
Governess	1		
Postmistress	1	Unknown	8
Proof reader	1	Married	56
Stenographers	3	At home	36
Student	1	Dead	9

The total number of pupils who had entered the school from its organization up to the year 1901 was 1,022. Of these the majority remained in the school from four to seven years.

The cost of the trades building was $36,000, and of its equipment $50,000, and the annual cost of maintaining the trade courses is $7,000. The cost of maintaining the school in all its branches for the year ending December 1, 1899, was $64,072.67, and the total amount expended for maintenance for twenty-two years of the school's existence was $1,668,695.81, of which $236,343.20 was for buildings. The funds used come entirely from an income of $75,000 per annum from the Miller endowment.

It is said by the school officials that the courses of instruction are excellent and can hardly be improved upon, and that the industries in the locality of the school and in many other localities have been benefited by its establishment for the reason that it has made it possible to obtain competent and skilled workmen. This and other similar schools have increased the intelligence of the pupils who have exerted a strong influence for good wherever they have located and have promoted the social, industrial, and educational development of workingmen. The pupils have located in all parts of the United States.

It is also said that there are no labor unions in the locality of the school, and as far as known no opposition to the school exists among labor organizations nor have they rendered it aid of any kind. The better preparation for work of the graduates has certainly procured them higher wages, steadier employment, and more rapid promotion. Employers generally prefer industrial-school men to the shop-trained workmen, because they are more intelligent and have more adaptability and they do not run so much in grooves and fixed ways. In many cases the graduates of this school are employed by manufacturing establishments without having to pass an apprenticeship; this is true of the Richmond Locomotive Works, the Roanoke Works, Toler & Sons, manufacturers of furniture, and others, but some firms do require a short apprenticeship.

In the opinion of the educators connected with this institution, this and other similar industrial schools have proved eminently satisfactory, and generally speaking have fully attained the end for which they were established.

INSTITUTE FOR COLORED YOUTH, PHILADELPHIA, PA.

The Institute for Colored Youth in Philadelphia was founded in the year 1837, upon the basis of a bequest by Mr. Richard Humphreys, which provided for the establishment of a school under the care of members of the Society of Friends, "having for its object the benevolent design of instructing descendants of the African race in school learning, in the various branches of the mechanic arts and trades, and in agriculture, in order to prepare, fit, and qualify them to act as teachers." The importance of instruction in the industrial arts having

claimed the consideration of the friends of the institute, and subscriptions having been made for the establishment of a department for this purpose, a separate building was erected, and in 1889 trade instruction was commenced. Instruction is free to colored persons 16 years of age or over, of good moral character. The school year begins October 1 and ends May 30. The courses of instruction include four-year courses in bricklaying, carpentry, printing, tailoring, and shoemaking, and two-year courses in millinery, dressmaking, and cooking. The classes in dressmaking, millinery, and cooking meet three days in the week. The hours for instruction in dressmaking and millinery are from 1 to 6 p. m., and the class in cooking from 10 a. m. to 3 p. m. The classes in bricklaying, carpentry, printing, tailoring, and shoemaking meet three nights each week from 7.30 to 9.30.

All pupils are first instructed in the use of tools, materials, etc., and then advanced by progressive steps until every detail is thoroughly mastered. The school is under the general management of a board of managers, which is composed of members of the Society of Friends. There are 8 instructors, all of whom have had practical training in the trades. The number of pupils in the different trades and classes during the year 1900–01 was as follows:

PUPILS IN EACH CLASS OF INSTITUTE FOR COLORED YOUTH, 1900–01.

Course.	Class.				Total.
	First year.	Second year.	Third year.	Fourth year.	
Bricklaying	7	1	1	2	11
Carpentry	9	7	4	2	22
Printing	5	1	4	2	12
Tailoring	10	8	2	2	22
Shoemaking	7	6	1	3	17
Millinery	22	15	.....	.....	37
Dressmaking	20	14	.....	.....	34
Cooking	50	35	.....	.....	85
Total	130	87	12	11	240

A large number of pupils leave the school without being graduated and take up the trades they have studied. Thus far only 180 pupils have received graduate certificates. The building occupied by the trade school is a three-story structure containing about 12,000 square feet of floor space, and, together with the equipment, cost about $20,000. The school is maintained by endowments and subscriptions from members of the Society of Friends. The cost of maintenance is $5,000 per annum.

The present courses of training and study are considered satisfactory. Regarding the general benefits to pupils and others, it is said:

The school has made better citizens and better mechanics of all those who attended its classes. If it were not for the opportunities that they afforded, a great majority of the pupils would be little better than poorly paid domestics or laborers. All graduates are qualified

to engage in practical work without undergoing a period of apprenticeship, and reports from recent graduates show that they are earning good wages at their trades. While most of the former pupils give the greater part of their time to the work which they began in the school, yet it is known that in many cases they devote a portion of each week to teaching others less fortunate than themselves. The social and educational benefits are manifested in many directions, and the lessons taught the men and boys in the night school are yielding rich returns in the homes, which are made better and happier by the intelligent and well-directed energies of the fathers and sons who have been under our instruction.

Generally speaking, feelings of race prejudice operate against the preference of the graduates, except among employers of their own color. Many of the former graduates are in business for themselves, and they invariably assist and give employment to the graduates of more recent date. It is stated that the school has in a general way proved satisfactory, and has attained the end for which it was established. The only drawback is the lack of interest manifested by those whom the school is intended to benefit. The instruction being free, they do not seem to appreciate its value, and therefore they are disposed to overlook the advantages which it affords. The management, however, has cause to feel gratified, for much good has been accomplished in the past, and there is every reason to believe that the future will be productive of still greater benefits to the class of people whose advancement and elevation has always been the sole object of the institute.

BEREAN MANUAL TRAINING AND INDUSTRIAL SCHOOL, PHILADELPHIA, PA.

The Berean Manual Training and Industrial School in Philadelphia was established February 1, 1900. The following statement regarding the purpose and work of this school was furnished by the principal:

The object of the school is to train the head, the hand, and the heart, and thus raise the standard of the pupil by improving the whole man morally, intellectually, and manually, and making him more valuable as a man and a citizen; to teach such trades as carpentry, bricklaying, electric-bell hanging, shoemaking, etc., for the boys, and dressmaking, millinery, cooking, and general housekeeping for the girls—trades at which the pupils can obtain ready and remunerative employment; to encourage, as far as possible, industries among the colored people, especially among those who have received instruction in the school, and in this way inculcate a spirit of productiveness among them. The school is open to any colored person of good moral character, upon payment of a tuition fee of $1 per month. The school year consists of three terms of three months each, the first term beginning October 1 and the last term ending June 30. Sessions for instruction are held three nights in the week from 7.45 to 10 o'clock. The courses already installed are carpentry, upholstery, electric-bell work, mechanical drawing, caning, dressmaking, millinery, and cooking. The course in carpentry requires four years, upholstery three years, caning one year, and the other courses two years. The school is under the general management of a board of trustees, which is composed of

prominent business and professional men. The immediate control is exercised by the principal of the school. There are ten instructors, three of whom are graduates of the Drexel Institute, two are professional teachers, and the others have had practical training in the trades. The number of pupils in each class during the first year was as follows: Carpentry 16, upholstery 15, mechanical drawing 10, caning 6, electric-bell work 10, dressmaking 30, millinery 20, cooking 20. The funds for the building and equipment were furnished by subscriptions. The value of the property devoted to the use of the school is $5,000. The school is maintained by contributions from prominent citizens and by tuition fees. The cost of maintenance is $3,000 per annum. The present courses of training and study are well suited to the pupils and are considered satisfactory. It is the intention of the management to enlarge the scope of the school by giving instruction in other trades also. The school has not been in existence long enough to warrant any definite conclusions regarding its influence, if any, upon local industries or conditions.

The experience thus far shows that the pupils are thoroughly interested in their work, and manifest a strong desire to improve their condition in life through the agency of the knowledge and training they will receive in the school. The first year's work has been satisfactory in every respect, and everything points to a large increase of pupils.

ST. JOSEPH'S INDUSTRIAL SCHOOL FOR COLORED BOYS, CLAYTON, DEL.

The St. Joseph's Industrial School for Colored Boys was founded in Clayton, Del., in 1896. This institution is an offshoot of a school that was established in Wilmington, Del., by the Josephite Order of the Catholic Church for the purpose of educating and training colored boys, so that when they reached the age of 15 they might be qualified to obtain ordinary employment in the various establishments of the city. After several years' experience in this direction it became apparent that the plan would not be practicable, as preference in such positions as the boys might be able to fill was usually given to white boys. This condition of affairs gave rise to the question as to what could best be done toward providing the colored youth with an education and training that would fit them to go out into the world and become useful and self-supporting men. After some deliberation it was finally decided that the wisest plan would be to establish a school where mechanical trades could be taught; and in keeping with this idea the school was founded.

The school is open and free to indigent colored boys, preferably orphans, though there are a number of boys in the school who were admitted because their parents are too poor to care for and educate them. In all such cases the parents agree that the school authorities shall have full charge of and be responsible for the maintenance and education of the boy until he becomes of age. This does not mean, however, that they are kept in the school until they become of age, for when a young man becomes proficient and able to maintain himself and can procure employment he is permitted to do so. The

object of the school is to educate and train the boy up to that point, and when that is accomplished he is assisted in procuring a position.

Ordinary school discipline is required and strict attention to instruction and work is demanded of all. Outside of this the pupils are at liberty to roam about the immense grounds at will, and visit about town when it does not conflict with their work or studies. The course of instruction includes theoretical and practical instruction in bread and pastry baking, cooking, shoemaking, tailoring, printing, cabinetmaking, stationary engineering, and electric-bell and wire work. The preliminary part of the instruction necessarily involves more or less manual-training work. At first the boys are allowed to select the trade they wish to take up, and if they show reasonable progress all energies are bent in that direction; if not, then they are advised to take up some other branch for which some special aptitude may be shown. During the winter months all pupils must attend school four hours each day and put in five hours in the shop. During the summer months the school is closed and the entire day is devoted to trade work and more or less work about the farm. Trade work is the main feature, however, and the boys are kept at this until they show proficiency. The school is under the general management of the Josephite Order of the Catholic Church.

There are 10 instructors, all of whom obtained their training by practical work. While there are varying degrees of efficiency in each branch, there have as yet been no established grades. At the present time the number of pupils in each branch is as follows: Cooking 2, baking 2, cabinetmaking 14, printing 6, tailoring 3, shoemaking 3, stationary engineering 2, electric-bell and wire work 2. Thus far there have been but 10 graduates, all young men who became proficient before they became of age and are now filling good paying positions. Six buildings, not including the chapel and immense barn, with a floor area of more than 20,000 square feet, are devoted to the use of the school. The value of this property, together with the equipment, is $80,000. The funds for the land, buildings, and equipment were provided by donations from the Catholic Church generally, through the efforts of the Josephite Order.

With respect to the courses of training and study, it is stated that, considering the class of pupils the school has to deal with, the curriculum is well suited for the purpose. The only thing needed in the way of improvement is additional machinery. Owing to the lack of funds the outlook in this particular is uncertain.

The benefits aimed at by the school are chiefly individual, and with respect to these it is said:

There can be no doubt about the good results accomplished by the school. Taking boys at their most receptive age and teaching them how to use their hands as well as their heads in producing something useful must and does bring good results to the pupils. It places them

in a position to earn an honest living and makes them self-supporting, self-reliant, and independent. Furthermore, the high moral influence which surrounds these young men not only tends to make them better citizens and more contented workers, but it is bound to bear fruit when they go out and mingle with the men in their trades, and the industrial, educational, and social status of all is sure to be benefited. Thus far the effect upon those who have been under instruction has been extremely gratifying. Most of the boys seem to appreciate what is being done for them, and they take a lively interest in their work. The few who have left the school to engage in trade work have met with good success, and they receive as high wages and have as steady employment as the general run of mechanics. The school has proved satisfactory in every respect, and is gradually attaining the purpose for which it was established. By combining the industrial with the moral and educational features it is felt that it is sending forth a class of young men who will be well qualified to provide for themselves and reflect credit upon the school and the race to which they belong.

BREWERS' SCHOOLS.

The few schools which have been established in this country for the training of brewers appear to have grown out of a need within the industry of a more exact scientific knowledge of the processes involved in brewing. Formerly there was a lack of brew masters thoroughly grounded in the fundamental scientific principles of brewing as well as expert in the work of the brewery. The business, it is said, was conducted largely by "rule of thumb." The brew masters knew little of the technology of the business as it is understood to-day, their knowledge of chemistry was somewhat vague, and the chemistry of fermentation was not understood as now. Consequently, there was a lack of certainty as regards the quality of the product and the work was attended by a large amount of waste. Thus to supply this need of technical education for those already employed in the business these schools were established. The scheme of instruction presupposes a familiarity with the work of the brewery and, as a rule, only such as have had experience are received as students.

The results from the work of the brewers' schools have been, in the opinions of the school officials, most marked both upon the industry and upon the students themselves. To the industry generally the work of the schools has been of great benefit. With the knowledge of the scientific methods as taught in the brewers' schools, many radical changes and improvements have been brought about in every branch of the industry. New methods have been introduced, guesswork has been eliminated, and the entire process of manufacturing, bottling, etc., has been reduced to a certainty. Materials which were formerly thrown aside are now converted into revenue-producing products and the matter of waste has been reduced to a minimum. Not only has it become possible to turn out a product that is purer, more healthful, of better

taste and stability, but in some instances the possibility of obtaining a third more product from a specified quantity of materials has been demonstrated.

The influence of the schools has extended beyond their immediate localities to the United States generally. The training has had a tendency to develop kindred industries, especially those making machinery for breweries and bottling establishments. The continuous experimenting carried on in the laboratories and model breweries of the schools has led to the development of new ideas, which have been taken up by machine shops and used in constructing new devices.

The school officials believe that no class of students receives so much valuable and useful instruction in so short a time as the students of these brewers' schools. From the time the graduates leave the schools they are qualified to work as brew masters, and they are always preferred by employers, because they possess a technical and scientific knowledge that is absolutely necessary to a brew master at the present day, and which can not be acquired outside of a brewers' school. Many cases are to be found where graduates have advanced from positions which paid $18 to $20 per week to brew masters at $2,000 to $4,000 per annum within a few years after leaving the school.

The opinion is expressed by the officials of the schools generally that an extension of the school term and a raising of the standard of admission are desirable. This would enable them to cover more ground and to devote more time to the subjects already taught.

Labor unions have not given the schools formal indorsement, but the good will of union men is evidenced by the fact that the secretaries of several local brewers' unions have been students in the schools.

UNITED STATES BREWERS' ACADEMY, NEW YORK, N. Y.

The United States Brewers' Academy in New York City was established in 1882 for the purpose of enabling those who were already engaged in the brewing business to obtain a thorough technical knowledge of the various operations in the different departments of the brewing industry. Applicants must be over 18 years of age and must have a good school education and previous experience in a brewery.

The school year, which is divided into two terms of four months each, commences the first week in October and continues to the 1st of June. Daily sessions are held from 9 a. m. to 1 p. m. Each term constitutes a full course of instruction and the charge for tuition is $300 per term. Lectures are held in German and English in separate classes, and the work in the laboratory and brewery is supervised by competent experts.

The course of instruction comprehends a systematic study and demonstration of the processes applicable to the brewing industry. Instruction is given in chemistry, physics, mechanics, mathematics,

microscopy, etc. The pupils are made familiar with modern methods of brewing and are taught how to examine and judge the quality of all brewing materials, how to recognize any fault in the product, and how to remedy or avoid the same. Special attention is devoted to the manufacture and treatment of all kinds of beers, ales, and porter, the apparatus used, and the conditions which must be observed in order to obtain a product of good taste and stability. In connection with the school is a model brewery of 10 barrels daily capacity, with all modern improvements, and also a pneumatic malting plant, where the pupils practice the preparation of all kinds of lager beer and ale, and the use of the different brewing materials is fully demonstrated.

The school is under the management of a board of directors. There are 5 instructors, 3 of whom are college graduates, and all have had practical training in the part they teach. There were 35 pupils in the school during the past year, and the number of graduates has reached 615. The building occupied by the school is rented. The equipment, which was largely contributed by manufacturers, is valued at $10,000. The school is maintained entirely by tuition fees. The cost of maintenance is $7,000 per annum.

NATIONAL BREWERS' ACADEMY, NEW YORK, N. Y.

The National Brewers' Academy was established in New York City in 1887. The object of this school is to afford thorough instruction in the theory and practice of lager beer and ale brewing.

The equipment of the school includes a model brewing plant complete in all its details, and a thoroughly equipped scientific and bacteriological laboratory, which is fitted up for and adapted to the special study of all micro-organisms connected with the industry.

The course of instruction is conducted in English, and covers a period of four months. There are two terms each year, opening, respectively, the first Monday in the months of October and February. The charge for tuition is $500 per term. The school is open five days in the week from 9 a. m. to 4 p. m. The studies are divided into four departments, namely: Theoretical and applied chemistry and physics; mechanics and mechanism; practice of brewing; and fermentation. In the first department the fundamental principles of chemical science generally are considered, the analysis of all materials used and of all brewery products, and the use of the polariscope and microscope. Mechanics and mechanism deals with steam generation and fuel economy, carbonic acid and the various gas collection, carbonating, bunging, racking, yeast-cultivation apparatus, ice and refrigerating machinery, cooling devices, etc. Practice of brewing treats of the properties of brewers' materials, the various brewing systems and their mashing, boiling, and cooling processes, and brewing calculations. The study of fermentation includes treatment of beers in the

cellar, complete fermentation by all known systems, the manipulation and preservation of bottling beers and ales, yeast and pure yeast culture, the lower organisms, saccharometrical calculations, etc. There are also systematic courses in bacteriology and pure yeast culture, by Hansen's methods, which are supplementary to the regular brewing courses. All experimental scientific and brewing work is performed by the students themselves, and frequent visits are made to well-known breweries and malt houses for the purpose of practical demonstration on the industrial scale.

The school is managed by a principal. There are 4 instructors, 3 of whom are college graduates, and all have had practical experience in the part they teach. There were 10 pupils in the school during the past year, and the number of graduates is 100. The building occupied by the school is rented. The equipment, which was furnished by the principal, is valued at $15,000. The cost of maintenance is $4,000 per annum, which is derived from tuition fees.

AMERICAN BREWING ACADEMY, CHICAGO, ILL.

This school was opened in 1891. The principal aim of the school is to afford the brewer a substantial scientific education which will enable him to judge independently and critically the brewing methods he may employ, and to modify them in accordance with the results desired. The course of instruction follows closely the progress of practical brewing operations, and opportunities are given the practical brewer to subject the brewing methods that are taught to practical tests in the experiment brewery connected with the school, and to see for himself that the results are in keeping with the teachings. The lectures are given both in English and in German. Students are at liberty to join either the English or the German class.

All applicants for enrollment must give evidence of having had a common school education and of being familiar with practical brewing operations. All who attend the sessions of the academy and pass the examinations receive certificates of attendance, giving their standing in recitations, exercises, and final examinations. A brew master's diploma is given to only such students as are of mature years and who give proof of having had practical experience in brewing and malting, covering a number of years, and who also pass the final examinations. The year is divided into two terms of four months each.

The course may be divided under two heads, viz: Demonstrations and exercises; lectures and recitations. Under the former head are embraced practical exercises in the chemical laboratory, such as the examination and use of thermometers, saccharometers, and other instruments; the saccharification of starch by acids and diastase; preparation of iodine and Fehling solutions, and determining sugar in worts, beers, and materials; the examination of materials, such as

barley, malt, corn products, rice, hops, sugar, water, pitch, etc.; the examination of beer for extract, alcohol, and sugar, and calculating original gravity and attenuation; and the comparison of theoretical and actual yield. Under this head is also embraced practical exercises in the microscopical laboratory and in the experiment brewery. The lectures and recitations cover brewing materials of all kinds, the principles and practice of brewing and malting, practical brewing operations, mathematics, physics, chemistry, brewery engineering, and the legal relations of the brewer to the Government. The tuition fee for the above course of four months is $300. Special courses are also offered: one of four weeks in the culture of pure yeast, for which the charge is $100, and one of six weeks in bottling, for which the charge is $150.

The equipment of the school consists of a complete experiment brewery, with malting plant and mill house, engine room complete with engines, boilers, pumps, filters, lubricators, etc., brewhouse complete with all necessary apparatus, cooling plant, storage and chip cellars, racking room, and a bottling department. Besides these there are chemical and bacteriological laboratories, libraries of reference, and a reading room supplied with current literature upon subjects of interest and value to the students. This equipment cost $28,000.

The faculty consists of 11 instructors, all of whom are graduates of universities or institutes of technology, either in Europe or America. The cost of maintenance amounts to $15,000 per year, and is met by tuition fees.

The average enrollment per term is 35, or 70 per year. The total enrollment since the opening of the institution has been 500, and of this number 500 have been graduated.

HANTKE'S BREWERS' SCHOOL AND LABORATORIES, MILWAUKEE, WIS.

This institution was formally opened as a school on February 1, 1898. The work of instruction really began in November, 1896, in connection with carrying on a laboratory and scientific station, and out of this grew the school. The purpose of the school is to instruct practical brewers and maltsters so as to qualify them to operate and supervise breweries and malt houses as experts in the special machinery of the trade as well as in the art of brewing and malting.

Students must be at least 18 years of age and have a common-school education. The school is open to practical brewers and maltsters, young men who know sufficient of the art of brewing to understand the technical terms and who intend to seek positions as technical brewers or superintendents after first having had theoretical instruction and a certain time of practical work in brewery and malt house.

business men who for their business interest want to gain some knowledge of malting and brewing, and chemists who wish to perfect themselves as specialists in the industry. Of these only brewers and maltsters who have already gained practical experience by working in a brewery for a certain time are entitled to a diploma.

The course of instruction embraces lectures upon brewing and malting; the materials and ingredients; physics and chemistry; microscopy, bacteriology, pure yeast culture; machines and apparatus; mathematics and accounts; law as affecting the industry; also laboratory exercises in use of instruments, examination, judging, and treatment of materials, etc., as barley, malt, rice, corn, sugar, sirups, colors, etc.; yeast study and culture, bacteriological examinations, etc.; also exercises in the school brewery in all the steps of manufacturing and treating beers. This instruction is supplemented by visits to many of the large malt houses and breweries where the operations may be observed on a large scale. The tuition charge is $250 per term of four months, including a special course in pure yeast culture.

The equipment of the school, which includes a small and complete experiment brewery, cost $4,500. The annual cost of maintenance is $12,000, which is met by the income from tuition fees and the laboratory work. The faculty consists of 5 instructors, all experts in the line of their instruction. The average attendance is 12. Altogether there have been 69 graduated from the school.

DAIRY SCHOOLS.

Dairy schools for instruction, both scientific and practical, in the care of milk and the manufacture of butter and cheese have long been in operation in several foreign countries. The first American school of this class was opened at Madison, Wis., in 1891, in connection with the agricultural college of the University of Wisconsin. It was established in the belief that a school in which butter and cheese making should be taught would be of great value to the dairy industry, and consequently greatly benefit the farmers. There was also felt to be a scarcity of trained men to take charge of creameries and cheese factories. While it was possible for a young man to learn the business in a factory, it was realized that to reach the best results he must have both scientific and practical training.

Iowa and Minnesota quickly followed Wisconsin in the establishment of these schools, both States making appropriations for the purpose in the same year. Other schools followed, and the rapid growth of the movement is indicated by the fact that in 1899-1900, according to the Report of the Commissioner of Education, there were over 1,300 students in attendance in 30 schools, all connected with the colleges of agriculture and mechanic arts.

The dairying industry has been greatly enlarged and improved as a result of the establishment of these schools. The schools have enabled the numerous creameries and cheese factories to get men trained in all that makes a strictly first-class dairyman. Besides this, they have been the means of increasing the general intelligence of the class of farmers which is most concerned in the growth and perfection of the industry. The Wisconsin school has been instrumental in giving larger application to the Babcock test, and this test has revolutionized the dairy business. It is used everywhere in the United States and in many foreign countries. It has been estimated that it saves to the Wisconsin farmers alone more than three-quarters of a million dollars annually. The test was invented by Prof. S. M. Babcock, of the Wisconsin school, and given to the dairying world free from patents that it might be within the reach of everyone who might be benefited by its use.

This and other dairy schools have not only attained the end for which they were established, but they have done far more than was at first contemplated or expected. There is room for still further advancement and greater usefulness. More time could be profitably given to practical and experimental work. There is little immediate prospect, however, of this being done.

The graduates of the schools are always preferred by employers because they are progressive, wide-awake, thinking, reading men.

DAIRY SCHOOL, UNIVERSITY OF WISCONSIN, MADISON, WIS.

This school is a department of the Wisconsin Agricultural College, which is a part of the State University. It was opened in 1891. It was the first school of its kind in this country, and has been taken as a model in other States.

The school is under the management of the president and 5 regents of the university. The corps of instructors consists of 8 professors and 11 instructors in practice. Three of the professors are from Cornell University, 1 from Yale Scientific School, 1 from the Ontario Agricultural College, 2 from the University of Wisconsin, and 1 has had no collegiate training. All of the instructors in practice are graduates of this school. There have attended the school at different times 1,022 pupils. The enrollment for the term 1900–01 was 120 in all grades. Certificates have been granted to 175 graduates.

No entrance examination is required. Students must be at least 16 years of age and have a common-school education. Everyone who takes the full dairy course must have had at least four months' experience in a creamery or cheese factory. There is a short course adapted to the needs of those who wish only to become dairy farmers, and an advanced course, the aim of which is to prepare the student for the duties of instructor in dairying or to assume responsible positions in advanced dairy lines. The university operates a creamery and cheese

factory, and also a pasteurizing plant in connection with the dairy school. The advanced course of instruction is comprehensive and thorough and covers every detail in butter making and cheese making.

To secure a dairy certificate the candidate must have spent a full term in the school and passed a satisfactory examination in all the subcourses. A standing below 60 per cent in any one examination makes the student ineligible to a dairy certificate. Further, he must have worked in a creamery or cheese factory for two seasons of not less than seven months each. One of these seasons must follow the period spent in school, and during this time the candidate must have practical charge of the factory in which he is working. He will report the operations of his factory monthly, or as often as directed, on proper blanks furnished by the university. The university holds the right to send an authorized person to inspect the factory of the candidate, and no certificate will be issued if an unfavorable report is made by the inspector. If all of the conditions are satisfactorily complied with the candidate will receive a dairy certificate. Owing to the expense of inspection, the university does not agree to grant certificates to students operating factories in other States.

The facilities for instruction are first-class in all respects. The main building, Hiram Smith Hall, was erected in 1891. It is constructed of Dunville white sandstone and white brick, the exterior of the upper stories being finished in pebble and beam work. The main structure is 75 feet front by 54 feet in depth, and three full stories in height. The boiler room and refrigerator form an addition 20 by 48 feet, one story in height. A machine shop 50 by 40 feet stands within 50 feet of the dairy building. This shop is two stories in height above ground, and has a full-sized basement room. In a one-story addition, 47 by 57 feet, are the cheese-curing rooms and the foreign cheese-making rooms. This addition extends partially into a side hill, and connects by a tunnel with the main building. Over this addition is a storeroom 26 by 36 feet. These buildings were erected with funds supplied by the State, and, including the equipment, cost $40,000. It costs $8,000 per year to maintain the school. This expense is met from State appropriations and fees from students.

Milk is delivered at a covered driveway in the rear, and from the weigh can flows by gravity into a large receiving vat on a platform in the creamery room. All of the latest forms of the leading power separators are in use for instruction. Near the center of the room are placed the cream-ripening vats; these include the common open vats and other more modern devices for this purpose. Besides these ripening vats and the separators, the creamery is equipped with two factory box churns, a 450-gallon combined churn and worker, a power Mason, or table butter worker, and butter-printing appliances.

Two instructors direct the work of the students running the separators, while a third supervises the students in charge of the cream ripening, the churning and working of the butter, and the butter printing.

The process of butter making is conducted daily on the creamery plan, from sampling and testing the milk at the intake to marking packages for shipping from the refrigerator.

The daily milk supply of about 5,000 pounds is furnished by farmers located within 8 miles of the school. These patrons are a fair representation of those furnishing milk to creameries and cheese factories in the State. By handling milk in such quantities and catering to a select trade, those in charge of the school are compelled, by the very nature of the work, to keep well to the front in dairy knowledge and practice.

At least six power separators, belt and turbine, are used by the students during the term. A test of the speed, capacity, and skimming efficiency of the separators is made each day. The effect of change of speed of the separator bowl, variations in temperature of the milk, and other practical observations are made with the different separators.

Cream is ripened at different temperatures and the effect of such changes on the butter noted. The temperature of churning and different ways of salting and working butter are studied in detail. Butter is put up in packages of different styles.

Automatic skim-milk weighers for apportioning to each patron his share of the skim milk are used at the creamery.

A detail of students, in charge of an instructor, receives the milk daily as it is delivered by the fifty patrons at the creamery intake. The students are taught to inspect the different lots of milk as they arrive. In addition to the usual inspection, taste, odor, etc., the students are instructed in the use of the Wisconsin curd test and the Farrington alkaline tablet test. These tests help to locate taints and acidity which would not be detected by the ordinary inspection. Composite samples for weekly tests of butter fat are also taken, and instructions given in the methods of preserving them.

The cheese room adjoining the creamery is 27 by 33 feet in area. In this there are eight steam-heated cheese vats of 300 pounds capacity, each equipped with a complete set of cheese-making apparatus.

Extensive additions to this department of instruction are being made. Several model and experimental curing rooms are so arranged that the temperature and moisture can be controlled. The subearth-duct method of controlling the temperature of curing rooms is also illustrated. Three rooms are provided for instruction in foreign cheese making (Swiss, Limburger, etc.). These include a making room, a salting room, and a special curing room for this kind of cheese.

In this department students are drilled in the use of the rennet test, which has done so much to advance cheese making, the use of the curd

mills, lactometers, and acid tests as applied to cheese making. They are given a thorough drill in judging cheese. Milk from the different patrons is examined by the Wisconsin curd test, which has proved so valuable in detecting those lots that are of doubtful quality in cheese making. The hot-iron test, both for indicating the time for drawing the whey and when to put the curd to press, is used daily. The milk and whey are tested, so that the losses in the process of manufacturing may be located. Instruction is given in the bandaging, pressing, and dressing of cheese, as well as the proper temperature of the curing room and care of cheese on the shelves. Samples of cheese from different sources are secured and the students given practice in scoring them, estimating their worth, and recognizing the demands of the market.

Three instructors are required to direct the work of students in Cheddar cheese making. The head instructor gives general directions and receives the blanks filled out daily by each student. He also marks all students under his charge. Each of the other two instructors has charge of the students on duty at four cheese vats.

Some one of the students at each vat is given a foreman's blank each day, while others give special attention to the rennet test, temperatures, salting, bandaging, and pressing the cheese. The work is systematically arranged, so that every student gets a thorough drill in the various manipulations of cheese making. Experiments are also made to show the effect which changes in the temperature of cooking the curd as well as different amounts of rennet or salt have upon the quality of the cheese.

The work of a creamery or of a cheese-factory operator requires a practical knowledge of engines and boilers. He should also understand the cutting and the fitting of iron pipe, soldering, belt lacing, etc. In order to give students such instruction, a machine shop has been erected for this purpose. In the basement of this building there are several large boilers, used for heating a number of buildings in the immediate vicinity. A smaller high-pressure boiler is available for instruction in firing and caring for a boiler. On the first floor of the building a room 35 by 48 feet is provided for giving instruction in running engines, putting up shafting, setting separators, and for studying the construction of pumps, water heaters, etc., and the second floor is fitted up with benches and appliances for teaching pipe cutting and fitting, belt lacing, and soldering. This work aids the students not only to better understand the machines they use, but helps to fit them for making repairs and improvements in the factory, machinery, iron pipes, vats, etc.

To be abreast of the times, the creamery operator and the cheese maker must be thoroughly skilled in the use of the Babcock test, an apparatus invented by Dr. Babcock, one of the instructors in the dairy school. Students are given thorough instruction in the use of

the Babcock and other simple milk tests, and are taught to determine accurately the amount of fat in samples of full milk, skim milk, buttermilk, and whey. Steam turbine, belt, and hand-power Babcock-test machines are provided. By the use of the test in connection with the Quevenne lactometer students are taught to detect watering and skimming of milk. With this test and a balance he can determine closely the amount of fat in a given sample of cheese.

The pasteurizing room is equipped with several modern power pasteurizers, a power bottle washer, sterilizing oven, bottle filler, and other pieces of apparatus and devices used for handling pasteurized milk and cream on a commercial scale.

A special course in the preservation of milk and cream for direct consumption is given during the latter part of the dairy school course. Several lectures on this subject are delivered. This course includes an exposition of the bacteriological principles underlying the methods of pasteurizing and sterilizing of milk and cream. The student is taught the conditions essential in apparatus for this purpose, the methods of manipulating the same, methods of restoring the viscosity of pasteurized cream, and the way that milk and cream should be handled so as to be guaranteed free from all disease germs.

At intervals during the term, and at the close, students in each of the subcourses are subjected to examinations, written and practical. Students are marked on a scale of 100 as perfect, and less than 60 as failing to pass. At the close of the term a written statement, signed by the dean, is furnished, giving the work performed by the student and his standing as shown by the examinations. Statements of standing are given only to students who have attended the full term and who have taken all the examinations.

Residents of the State of Wisconsin taking the dairy course pay fees amounting to $10. Those living in other States pay $45. For instruction and practice in the shop, an additional fee of $5 is charged all students. An additional fee is charged for special and advanced laboratory work in bacteriology.

In addition to the sums named, each student must deposit $2 with the secretary of the university to cover possible breakage of test bottles and loss of key to locker. At the close of the term, if there has been no breakage of test bottles and key is returned, the latter sum is refunded to the student, or a portion only if the key is lost or apparatus broken. Breakage which can not be located is equally divided among the students.

DEPARTMENT OF DAIRYING, IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, AMES, IOWA.

This school is a department of the State College of Agriculture and Mechanic Arts. It is the result of an appropriation by the State in 1891, made for the establishment of a dairy school.

The facilities are adequate for teaching dairying in a thoroughly practical and scientific manner. The dairy building is well equipped for practical work as well as scientific instruction and investigation. It is more than a dairy building as the term is generally understood. It is a practical working creamery and cheese factory, in operation every week day in the year. During the summer season from 15,000 to 25,000 pounds of milk are taken in daily and manufactured into butter and cheese; during the winter somewhat less. The milk is purchased from farmers living in the vicinity of the college, and they are paid for it according to its merits based not only on butter fat determined by the Babcock test, but upon inspection of its cleanliness, freedom from all taints, objectionable odors, and other general qualities. A bacteriological laboratory affords facilities for instruction and investigation in this important feature of the subject.

The college creamery is in operation the year round. The work is conducted on a commercial scale as well as for the purposes of scientific investigation and instruction. The product made invariably brings the highest quotations and has attained an enviable reputation in the markets.

The student becomes familiar with everything connected with the management of a commercial creamery, and meets every problem that is likely to confront him in his future work. Five different kinds of separators are used in the dairy building and the most approved machinery is used throughout.

The courses in dairying were established for the benefit of those who are already engaged in the business, either on the farm or in the creamery or factory, and for this reason a very large portion of the time is devoted to practical work in the dairy building.

Students in these courses are taught everything connected with practical dairying, from weighing the milk brought in by the different patrons, and testing the same, to running the engine, scrubbing the floors, and shipping the butter. The aim is to teach not only how to do all the work incident to a business of this kind, but also why—the reason—the work should be done in the manner taught. The studies other than dairying proper which appear in the courses outlined are such as are necessary to a correct understanding of the principles involved, and all students entering these courses are required to attend them regularly.

The school is under the general management of a board of trustees. There are 7 instructors. One of the instructors was educated at the Ingersoll School, Ontario, Canada, 1 at Manhattan College, Kansas, and 5 are graduates of this school. The school building was erected and equipped by the State in 1891, and cost altogether $25,000. The instructors render service in other departments of the college, and only a part of their salaries is properly chargeable to the dairy school.

It is estimated that their services in this school are worth $3,000 per year. The school is nearly self-supporting from fees and from the profits arising from the creamery and cheese factory operated by the faculty and students. When these sources fail to afford sufficient funds, the State supplies the deficiency.

The annual enrollment in all grades is 120. Many of the students take only one of the shorter courses. The number of graduates, those who have taken the full year course and passed the examinations, therefore, is only 85.

No branch of industrial education has proved more popular or has been productive of better results than the instruction furnished in the economical production of a superior class of dairy products. Even the city milk-supply business is calling for scientifically trained men who thoroughly understand the essentials for proper sanitation and cleanliness, pasteurization, and sterilization. In order to meet the demands for such instruction, the dairy school provides a four weeks' course for butter makers and cheese makers, beginning the second week in January; two sixteen weeks' courses, one beginning with the regular college year in September, the other with the second college term in February; and a one-year course. The first is only for experienced butter and cheese makers. The other courses are open to all.

The one-year course in dairying is designed to meet the wants of those who wish to acquire an intimate knowledge of dairy methods and the underlying principles as well as the sciences related thereto. This course runs through one college year, beginning September 1 and ending in June, with an omission of about two months in midwinter. Students completing this course will receive certificates, but the right is reserved to withhold such certificates until satisfactory evidence is furnished of ability to successfully manage commercial creameries or other large dairy establishments.

Following is the course of study pursued:

First term: Dairy practice, six days per week; milk and its product, 16 lectures; milk testing, 20 lectures; bookkeeping, 16 lectures; bacteriology of milk, 20 lectures; judging dairy stock, 16 lectures.

Second term: Dairy practice, six days per week; cheese making, 16 lectures; pasteurization, 16 lectures and laboratory work; dairy machinery, 10 lectures; feeding dairy stock, 20 lectures; dairy chemistry, 16 lectures.

The course of study pursued in each of the sixteen weeks' courses is as follows:

Dairy practice, six half days per week; bacteriology of milk, 20 lectures per term; bookkeeping, 16 lectures per term; dairy machinery, 10 lectures per term; milk testing, 20 lectures; milk and its products, 16 lectures; judging dairy stock, 16 lectures, or feeding dairy stock, 20 lectures.

A winter course in dairying is conducted for the benefit of those who wish to make a special study of dairying and the sciences closely related thereto, and who are not able to attend either of the summer

dairy courses. It begins the second week in January and continues four weeks. It is largely attended by men who have had experience in dairy work, but feel the need of a more thorough knowledge of the principles which underlie the science of dairying and the most improved methods employed, and it is desired that the attendance be limited to this class. Being held during the winter, a great many men who have charge of creameries and cheese factories during the summer are able to attend, and those who have done so have expressed themselves as being greatly benefited thereby. On account of the limited time in this course it is not expected that students will take both butter and cheese making. Those who wish butter making are expected to take all the lectures except those on cheese making, and to do all their practical work in the butter room. Those who take cheese making are expected to attend all lectures except those on butter making, and to do their practical work in the cheese room.

The course of study outlined is as follows:

Work in dairy building, six half days per week; butter making, 10 lectures, or cheese making, 10 lectures; dairy chemistry, 10 lectures; bacteriology of milk, 15 lectures; bookkeeping, 10 lectures; milk testing, 10 lectures; dairy machinery, 10 lectures; scoring butter and cheese, 5 lectures; feeding dairy stock, 10 lectures.

This course, as stated above, is designed to meet the wants of experienced butter and cheese makers, and students without previous experience are not admitted.

Students in all of the dairy and creamery work are required to provide themselves with white suits, keep them clean and in good order. One-half of the expense of laundering creamery suits is refunded at the end of each term to all students who have passed a satisfactory inspection in work and cleanliness during the term.

The scope of the work given in the department of dairying is set forth clearly in the following statements:

Dairy practice: This includes from five to seven hours of practical work in the creamery room during the first term of the year's course, the two summer courses, and the winter course. It includes butter making and laboratory work in milk testing. In the second term of the year's course it includes cheese making and pasteurization.

Milk and its products: This includes instruction on the composition of milk and dairy products, the theory of centrifugal separation, and the construction of the various kinds of separators. Special attention is given to the effect of varying conditions of the milk on separation. It includes a consideration of the principles of cream ripening, churning, and the preparation of the butter for market.

Milk testing: This includes a thorough study of the Babcock test for dairy products, with special instructions for overcoming the difficulties from varying conditions. The tests for determining acidity of cream and milk and the use of the lactometer for detecting adulterations are included; also composite sampling and testing of individual cows.

Dairy machinery: This embraces instruction for firing boilers by the most economical methods, the construction and operation of engines and pumps, and the placing of machinery and shafting.

Bookkeeping: This course is designed to inform the student as to the best system of bookkeeping for the business of the factory.

Bacteriology of milk: This course consists of lectures on the nature of bacteria, distribution, and the conditions necessary for their growth. The effects produced by various bacteria commonly found in milk are shown by lectures and demonstrations. The methods of handling which cause contamination of milk are considered in detail. That the quality of dairy products depends mostly upon the fermentations which have taken place in these preparations is shown with detailed attention to the use and value of starters in butter and cheese making. The principles of cream ripening and pasteurization are also included.

Judging dairy stock: In this course the judging of dairy stock with the score card and by comparison is made a leading feature, while the lectures relate mostly to the principles, methods, and practices of breeding dairy stock and their management.

Cheese making: In the winter term, this consists of ten lectures on Cheddar cheese, including a study of the kind of cheese demanded by different markets, etc. In the second term of the one-year course the same work is taken up as during the winter term, but with the addition of six lectures on fancy brands of cheese, including Limburger, brick, Swiss, Roquefort, sage, Stilton, pineapple, and Gouda.

Pasteurization: Second term, one-year course in dairying. The subjects treated in this course are the relation of the milk supply to public health, the principles of pasteurization, and apparatus adapted for various purposes, with the practical operation of the more common machines. The production and sale of "sanatory" milk is taken up, together with a general consideration of the market milk business, the use of preservatives, and allied topics.

Feeding dairy stock: Second term, one-year course in dairying, and winter course. Special attention is given in this course to the principles of feeding animals for the most economical production, with a study of the composition and use of various feeding materials and the feeding of dairy cows, including the influence of various feeding stuffs on the quantity, quality, and composition of milk, butter, and cheese.

Dairy chemistry: The chemical composition of dairy products is considered in a general manner. The alkali test, both in theory and practice, is given in order that it may be used by the student. The adulteration of butter, cheese, and milk as it relates to the dairy industry is also taken up in the lectures. As a whole, the work is intended to furnish a foundation for the student which he can use as a basis for future study.

Scoring butter and cheese: These lectures are designed to give the student a correct idea of the standard market requirements for dairy products. Butter and cheese are examined and scored by the students and their judgments compared with that of the instructor.

Fees: The fees, covering charges for breakage, laboratory material, janitor's service, and incidentals, amount to $12 to $15 per term.

While no change in the course of study is now contemplated, the management realizes that there is always room for improvement. These improvements are constantly suggested in the course of the work. The influence of the school for good has been notable. The number of creameries in the State has increased, and the products of creameries and cheese factories have been made more uniform in quality, and that quality has been greatly improved. As a consequence of this improved quality of products better prices are obtained. Neighboring States have received benefits along the same lines, though not to the same extent, because most of the graduates of the

school have found employment in Iowa. The work of the school has multiplied interest in the dairy industry, and the general community is much better informed on dairy subjects.

The graduates of the school are much more capable than are those who have not had school advantages. Through them the dairy industry has been completely revolutionized. New methods of management have followed the school, and to-day the industry stands on a plane incomparably higher than it did before the school was established. Employers prefer the school-trained dairyman because he is better equipped in the science and practice of his trade than it is possible for the mere shop-trained man to be. He makes a superior product at no greater cost than the inferior workman makes a poor one. Not a year has passed since the establishment of the dairy school in which inquiries and demands on the part of employers were not largely in excess of the number of competent students. The average wages of a shop-trained butter maker is about $10 per week, while the school-trained man commands about $16 per week.

DAIRY SCHOOL, UNIVERSITY OF MINNESOTA, ST. ANTHONY PARK, MINN.

This school is situated at St. Anthony Park, midway between the cities of Minneapolis and St. Paul. More than ten years ago it began to appear that wheat raising in Minnesota was becoming less profitable than it had formerly been, and the repeated failures of this crop had a very discouraging effect upon the farmers. There was no doubt in the minds of observant men that with some effort the dairy industry could be developed into a prosperous business and perhaps relieve the farming community of its embarrassment. To promote this new industry it seemed necessary to provide a school in which men could be trained for this work. Under these circumstances the legislature in 1891 appropriated $15,000 for building and equipping a dairy school, and it was made a part of the agricultural college at the State university. The building was completed and the school was opened in October of the same year. The growing demands upon the school made it necessary to increase its capacity, and in the winter of 1895-96 the State made an additional appropriation of $15,000, thus making the total cost of building and equipping the school $30,000.

The course is designed to furnish persons who are actually engaged in the manufacture of butter and cheese, or who propose to take up this work, an opportunity to become more skilled in their work, and also to study the many problems which have a direct bearing upon the dairy industry. In recognition of the fact that such persons can not be away from their business for a long period, the term has been arranged to cover only four weeks, and every hour of every working day is fully occupied by lectures and actual work in the factory.

Instruction is divided into six courses: Lectures covering the entire field of dairy husbandry; practical work daily in the butter room; practical work daily in the cheese room, where the manufacture of flats, Cheddar, Swiss, brick, Edam, and Gouda cheese is carried on; practice work in the laboratory examining milk, making daily composite tests, and the pasteurization of milk and cream; practical engineering, steam fitting, and plumbing; and practical work in factory bookkeeping.

Ten instructors give a portion of their time to this school. One of them is from Cornell University, 1 from Johns Hopkins University, 1 from the State Agricultural College of Iowa, 1 from Carlton College, 1 from the University of Wisconsin, and 5 are from this school. Owing to the shortness of the term the amount charged to this school for instruction in 1900 was only $1,727.46. The fees from students and the profits from the sales of butter and cheese made in the school factory not only met this expense, but showed an actual profit over and above it of $303.84.

The enrollment in 1900 was 99 in butter making, 2 in cheese making, and 1 taking both courses, or a total of 102.

Dairy certificates are granted to students who have taken the course and passed a satisfactory examination and in addition have demonstrated by one year's work in a factory that they are skilled in the art of butter or cheese making, and are thoroughly qualified to take charge of a creamery or cheese factory. Eighty-four such certificates have been granted since the opening of the school.

The school officials believe that the course of study should be extended and broadened. This is especially desirable in laboratory work, and no doubt it will soon be done.

The practical benefits growing out of the school have been great. Ten years ago the annual value of the dairy products of the State was a little over $3,250,000. A careful estimate now places the annual value of these products at more than $32,000,000. And the prospective benefits from the school are greater still. With the proper feeding and care of dairy cattle it is claimed that the annual production of butter can be increased many millions of dollars. This knowledge of feeding and caring for cattle will be gradually disseminated through the men who leave the school. Every graduate is a missionary of intelligence to the community in which he works. These graduates have developed the industry from almost nothing to its present gratifying proportions. They all find employment at good wages. As a matter of fact, a man who has not attended a dairy school can not obtain a position if a school man can be had. This preference for the school man is on account of his superior knowledge. He is a scientific butter maker, and gets the most out of the business.

SCHOOLS OF DRESSMAKING, MILLINERY, DOMESTIC TRAINING, ETC.

Education in the trades of dressmaking, millinery, domestic training, etc., is given in a large variety of schools. Many city public schools give some instruction in sewing and cooking to all girl pupils. But only those schools will be described here which give such instruction for the purpose of providing a means for the self-support of the graduate. The Young Women's Christian Association classes in many of the cities have long been doing notable work of this character. The Boston association began its instruction for domestic servants in 1888, and later added the trade courses in dressmaking and millinery. The Women's Educational and Industrial Union of Boston was also a pioneer in the same class of instruction.

Instruction of a more ambitious character in the same subjects is found in Pratt Institute, Drexel Institute, and Armour Institute. The courses there are longer, and consequently can be made more thorough. The training given in these schools, especially in Pratt Institute, has had a great influence upon the work of other schools, many of their graduates having become instructors elsewhere. Of the schools mentioned, only Armour Institute is here described. Pratt Institute is placed with the building and mechanical trade schools and Drexel Institute with the technical and continuation schools, their more important work being of those classes. A description of their courses of instruction in dressmaking, millinery, etc., will be found with the details for the schools as a whole.

Another class of schools doing useful work in these lines is the industrial schools for the colored race in the South. Particulars will be found under the proper head. White schools in the South giving instruction of like character are fewer in number and their work is of less importance industrially. Details are given under the proper group of schools.

The schools for teaching dress cutting and dressmaking conducted under private auspices form another type. They furnish instruction to large numbers, particularly in various systems of dress cutting. They are business enterprises conducted for gain. Their pupils are made up in large part of women who wish to learn cutting and fitting in order to do their own work. Representative schools of the class are described.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, BOSTON, MASS.

The special need leading to the establishment of the training school for domestics was the lack of properly trained house servants. For years the association had maintained an employment bureau, and the incompetence of the majority of those who asked for work resulted in

the establishment of this school in 1888. This incompetence results from many causes, ignorance being one, and the fact that there is apparently a stigma cast upon the work of house service itself. The cause of this is not alone the fault of the employees, but belongs at least equally to the employing class, due to the way in which servants are treated by housekeepers, their looking upon servants as menials and inferiors and allowing them so little freedom or independence.

This side of the difficulty can not be cured by the school. The problem must be approached from the side of the housekeeper. This the association attempts to do by training the housekeeper in its school of domestic science and Christian work, a school outside the scope of this investigation. These two ideas, the training of the servant and the training of the housekeeper, taken together and extended throughout the country should do much to solve the problem of good domestic service.

The courses of dressmaking and millinery really form part of the association's school of domestic science, whose object it is to give scientific and practical instruction in all that pertains to the home and its management, that young women may be fitted to teach domestic science and arts in schools, institutions, and homes, to be Christian workers in associations, settlements and slums, and to be matrons, housekeepers, and houseworkers. The difficulty of obtaining a systematic and thorough training in dressmaking and millinery in the shops has, however, led to many taking these courses with only the end in view of fitting themselves to be competent and capable dressmakers and milliners. In the shops the first object in view is to use the girl so as to get the most possible out of her; that is, she is kept doing those things for which she seems to show the most aptitude, and no effort is made to teach her the whole trade. It is claimed by the management of the association that its school furnishes complete training in dressmaking and millinery and fits those taking these courses for the practice of the trades.

For admission to the school of domestics good character is the first qualification, and testimonials must be presented. Pupils can be admitted only upon an agreement signed by themselves or their guardians that they will remain at least six months, and if they leave before the expiration of this period they are to be charged at the rate of $2 per week from the time of admission to that of leaving. If, however, they complete the course of six months the instruction, including board and tuition, is entirely free, the applicant being expected only to furnish a suitable outfit and to enter on a week's probation. No girl is admitted under the age of 16 years. Each graduate is awarded a diploma at the end of the course, stating only those lines of work for which she has shown special aptitude. The system of marking is a great incentive to good work. Each piece of work done is scrutinized with care, and for every piece of work presented as complete

which does not meet with the approval of the instructors the pupil loses a certain number of marks. The aim is perfection, and no excuse for neglect of duty is accepted. The course includes cooking and sewing, general housework, chamber work, parlor work, laundry work, home nursing, sewing and mending, reading and spelling, penmanship and letter writing, arithmetic and geography, and daily scripture lessons.

The aim of the English lessons and studies, outside of the domestic training, is to quicken the perception of the pupils, and the result in almost every instance is a complete transformation in the girl. One of the promising guaranties of the permanent success and growth of this school is the fact that 95 per cent of the girls who have entered the school for some years past have come through the direct influence of former graduates.

The courses in dressmaking and millinery, in detail, are as follows:

DRESSMAKING.

Educational sewing: Swedish sampler; basting, stitching, and overcasting; overhanding; folded edges; folded edges, matching stripes; overhanding selvedges; hemming; fell seam; French seam, with bias finish; gathering, stroking, and putting on bands; making buttonholes and eyelets; sewing on buttons; making loops; sewing on hooks and eyes; putting in gussets; herring-bone stitch on flannel; grafting for mending undergarments; overhand patch; hemmed-in patch; cashmere darning; stocking darning; hemstitching, fringing, and damask hem for linen; tucking, and whipping ruffles; mitered corners, chain stitching, feather stitching, slip stitching; cross stitching.

Machine sewing: Care and use of the sewing machine, including hemming, tucking, ruffling, and sewing on lace.

Study of textiles: History and processes of manufacture of fabrics such as cotton, wool, silk, and linen, and of sewing implements such as scissors, thimbles, needles, and pins; lectures, collateral reading, papers, and field work.

Drafting and making of undergarments: Bibs, child's skirt, girl's skirt, lady's skirt; child's drawers, girl's drawers, lady's drawers; child's first waist, girl's waist; child's nightgown, lady's nightgown.

DRESSMAKING PROPER.

First course, twelve lessons: Use of Vienna tailor system; taking of measurements; drafting for stout forms; fitting and making in practice material; matching stripes and plaids; study of dress material as to color and texture.

Second course, twelve lessons: Designing, cutting, and making wool dresses.

Third course, twelve lessons: Study of general principles; drafting and making shirtwaist; drafting and making walking skirt.

Fourth course, twelve lessons: Drafting and making jacket; drafting child's dress.

Fifth course, twelve lessons: Drafting and making muslin gown.

Special attention is given to study of color, form, line, and appropriateness of design throughout the course.

MILLINERY.

First course, twelve lessons: Renovating material, velvet, ribbon, feathers; wiring, making and placing folds; fitting facing; lining hat; bow and simple rosette making; making and trimming practice hat of canton flannel; making and trimming velvet hat.

Second course, twelve lessons: Draping; making and trimming toque or turban; binding edge of hat; making bandeau; drafting and making frames of buckram; making and trimming bonnet; study of children's hats.

Third course, six lessons: Shirred facing; fancy rosettes; use of lace, silk, and flowers; making straw hat and trimming same; trimming summer hats.

DRAWING.

This course is offered to assist the pupils in illustrating the lessons in educational sewing, also in making rapid sketches of gowns and hats. Lectures are given on color, form, and line to awaken the pupil's interest for the beautiful in dressmaking and millinery.

In the school for domestics there are 3 instructors, all graduates of the school of domestic science, and 1 a college graduate. There is 1 instructor in dressmaking and 1 in millinery.

During the school year 1899-1900 there were 20 pupils in the school for domestics, 12 in the dressmaking class, and 10 in the class in millinery. Up to the end of the school year there had been 1,100 graduates from the school of domestics, 150 from the class in dressmaking, and 120 from the millinery class.

The approximate annual cost of maintaining the school for domestics is $2,000, of the dressmaking course $300, and of the millinery course $225. The funds are obtained from contributions, legacies, annual subscriptions, personal gifts, and fees paid by certain classes.

These trade courses could be improved by better accommodations, more room, and more practical work. With these more pupils could be trained, as many applicants are now turned away. The courses could also be further extended so as to teach more of the higher branches of the trades. It is all a question of expense, and improvements are contemplated when more money is at hand.

The demand for trained house servants is greater than the supply, and as the trained servant receives wages about one-third larger than the untrained the school for domestics in its results ha acted as a stimulus to the untrained. The benefits of this school have been felt quite generally throughout the whole country, as the graduates are located in very many localities, and the school, being the first of the kind established in the United States, has by its example and success resulted in the establishment of other similar schools. The courses in dressmaking and millinery have benefited those trades in Boston and vicinity, not only because they have sent out a number of competent workwomen, but because many of the graduates have become teachers of these trades at night classes maintained by churches, etc. These courses have resulted in setting the standard of work in the shops higher than it formerly was, and the example of the graduates has stimulated those trained only in the shops to do better work.

The general intelligence and efficiency of the employees in dressmaking and millinery establishments has undoubtedly been increased as a result of the training in this and similar schools.

Higher wages, steadier employment, and more rapid promotion have accrued to those who have been under instruction in these courses, and, generally speaking, their moral condition has been improved as a result of the Christian training which forms part of the courses.

The school for the training of domestics has revolutionized the domestic problem in this locality and has stimulated a healthful rivalry in other organizations.

Skilled labor is always preferable to unskilled, and the knowledge of the graduates from these courses is more practical than that of the nongraduate. For these reasons graduates are much preferred by employers, but many do not employ the domestic servants trained here from inability to afford it, as they invariably command higher wages than the ordinary servant.

Those trained in the courses of dressmaking and millinery can always obtain employment without passing through a period of apprenticeship.

In a general way these courses of instruction have proved satisfactory, though much remains to be done before perfection is reached.

WOMEN'S EDUCATIONAL AND INDUSTRIAL UNION SCHOOL, BOSTON, MASS.

This school comprises courses designed to teach the trades of dressmaking and millinery and in addition a course for houseworkers. These courses are comprehensive and systematic and impress upon the pupil the value of order, accuracy, and economy.

Instruction in dressmaking and millinery is given by means of lectures, practical work, and examinations. Pupils furnish their own materials and make articles for their own use. Three terms of 24 lessons each are necessary to complete a full course in dressmaking and in millinery. A work test is required to join the dressmaking class. Dressmaking and millinery classes meet twice a week; sessions two hours each.

Millinery: Instruction is first given in the making and trimming of all varieties of hats, followed by methods of making bonnets, toques, and turbans. Special attention is given to making tasteful and stylish ribbon bows, and feather curling is taught in this course. Advice is given upon the suitability of materials, combinations of colors, and character of lines and forms. Day classes meet at 10 a. m. and 2 p. m., and a fee of $10 is charged for a term of 24 lessons; evening classes meet at 7.30, and a fee of $5 is charged for a term of 24 lessons.

Dressmaking: Preparatory course—This course includes buttonhole making, machine sewing, and the drafting, cutting, fitting, and making of undergarments and dresses of wash material. A day class only is formed in this course, and a fee of $5 for 24 lessons is charged.

Regular course—In this course the pupil is taught the making, drafting, and fitting of different styles of skirts and waists. Pupils are shown a variety of materials and are instructed in regard to the texture, color, and suitability of each for

various uses. In the third term the plain, thorough work of tailor-made suits receives special attention. Day classes meet at 10 a. m., and the fee for each term of 24 lessons is $10; evening classes meet at 7.30, and a fee of $5 is charged for each term of 24 lessons.

A special normal class in dressmaking and millinery is formed for women wishing to fit themselves as professional workers or for teachers of dressmaking or millinery. There is a small but growing demand from clubs and schools for trained teachers in these branches. It is thought that a six months' course will prove an adequate preparation for this work.

There are 2 teachers for these classes, 1 for dressmaking and 1 for millinery, and both are graduates of the Pratt Institute. During the year 1899-1900 there were 22 pupils in the dressmaking classes and 18 in the classes in millinery.

In the course for houseworkers—that is, for the training of domestic servants—the aim is a scientific study of the home, to discard what is useless, to save what is of permanent good, and to bring it into line with present industrial tendencies and scientific facts, social and physical. This full course is not designed to train wage-earners, but housekeepers—the wife and the mother—not to the end that the homes of any one class may be bettered, but that the standard of living and life may be raised in all homes. The course for houseworkers is designed to fit young women for the various branches of housework—to teach them the occupation of house servants.

The first reason for the establishment of this course was the lack of trained servants and the belief that housework is a trade, and that the woman on whom the care of a household falls, whether she be employer or employee, should have a special training for her work. The union learned, as one of the results of conducting an employment bureau, that while there was an oversupply of those who sought employment, yet the demand for trained servants was much greater than the supply. Another reason which led to the establishment of this course was to provide an occupation and employment for the many girls who were trying without success for places in factories and shops.

In order to get a good class of girls into this course it has been found that much prejudice among them has to be overcome. In going into service they seem to lose caste among their associates. They look upon it as a variety of slavery and not as a trade, and they dread the unregulated hours. The trouble with domestic service to-day is not alone the poor training of the servants, but of the housekeepers also, who often have too little knowledge of housekeeping itself to realize fully the size and burden of the task they put upon their servants. They are also very often too regardless of the rights of the serving class. The ideal system is the training of both the housekeeper and the house servant, which, if developed and extended throughout the country, would go far to help in this matter.

The full course for houseworkers is made up of courses in cooking, in parlor work, and in chamber work. Detailed courses are as follows:

Cooking: Care of fire; care of sinks and traps; care of kitchen, pantry, cellar, and ice chest; preparation of cereals; making bread, biscuit, and muffins; making plain soups; roasting, boiling, braising, and broiling meats; cooking eggs, fish, and oysters; cooking vegetables, fresh and canned; making tea, coffee, chocolate, and cocoa; making plain desserts.

Chamber work: Care of bedrooms, beds, and bedding; sweeping and dusting; care of toilet and bathrooms; plain washing and ironing; care of bed linen.

Parlor work: Care of dining room; care of silver, glass, and china; arrangement of table and service; care of parlor and halls; answering doorbell properly, etc.; plain washing and ironing; care of table linen.

The course in cooking covers a period of thirty-six weeks and the courses in parlor or chamber work a period of eighteen weeks each. Upon the satisfactory completion of her course the pupil is given a certificate. She is then placed with an employer to serve a probation of three months before receiving her diploma. The certificate does not imply the fitness of the pupil to work outside the school under different conditions and does not alone entitle the pupil to expect higher wages than $3.25 per week.

Diplomas are given to pupils who have satisfactorily served their term of probation and have passed an examination in practical housework and also in the underlying principles of hygiene, in which instruction is given during the course. A diploma insures a position that is obtained through the office of the Domestic Reform League. The grade of the diploma determines the wage which the pupil may expect to receive on graduation, as follows:

WAGES USUALLY RECEIVED BY GRADUATES IN COURSE FOR HOUSEWORKERS.

Grade.	Weekly rate of wages.	
	Parlor or chamber maids.	Cooks.
A	$4.00	$5.00
B	3.75	4.50
C	3.50	4.00
D	3.25	3.50

To those taking this course no charge is made for room, board, and tuition, but in exchange for these the pupil gives her service to the school during the whole course.

There are 2 instructors in the course for houseworkers, 1 of whom is a graduate of Chicago University and 1 a graduate of Pratt Institute. During the year 1899–1900, 10 pupils were taking this course of instruction.

The records of the students in these classes are imperfect, and in consequence the number of graduates in dressmaking, millinery, and houseworking can not be stated accurately.

The annual cost of maintaining these courses is approximately $3,000 for the course for houseworkers and $1,800 for the courses of dressmaking and millinery. This is exclusive of rent of buildings, which can not be stated. The funds used in maintaining the courses of dressmaking and millinery come from fees paid by the pupils, but those used in maintaining the course for housekeepers come partly from a list of sustaining subscribers, partly from gifts by the public in response to appeals of the union, and partly from two scholarships.

It is stated that the courses of dressmaking and millinery are thorough and effective and that it is not likely that they will or can be much improved in the future. The course for houseworkers might be improved, though the outlook for it is not good. A good training is given at present, but the attendance is small, as the course does not seem to be attractive. Some connection with the public schools seems necessary, so that the girls may be obtained before they are caught by the factory or shop.

As a result of the establishment of these courses the standard of work in dressmaking and millinery has been raised in this locality and a nucleus of trained and competent domestic servants has been formed from which it is believed good results will come in time. The schools for teaching housework existing in this locality have aroused quite generally the interest of the housekeepers and caused many of them to make greater efforts not only to train servants, but to make the life passed in domestic service more agreeable.

Even at the start, the girls trained in these courses get better wages than others. The girls are taught that they should not come into the school with the sole idea of being able to make more money, but with the purpose only of perfecting themselves in their trade.

It is natural, however, that they should want all they can get, and their attainments are such that those who can afford it are willing to pay them more than others not so well trained. The result of this is that, instead of relieving the troubles arising from poor domestic service among those who feel them the most, the courses for domestics seem to be training servants for the wealthy only.

The graduates are greatly preferred by employers to those whose training was obtained in homes or shops only because of the higher character of their training. The dressmaking and millinery courses have proved eminently satisfactory and have already well attained the end for which established, but this is not as yet true of the course for houseworkers.

PEOPLE'S INSTITUTE, BOSTON, MASS.

This school was founded by the Robert Treat Paine Association and opened to the working people of Roxbury October 2, 1890. Its objects, in the words of its constitution, are "to furnish working people the

means of mental and moral improvement, mutual helpfulness, and rational recreation." With the above end in view the institute has established club rooms, shower baths, bowling alleys, rooms for the playing of games, evening classes and lectures for the teaching more or less thoroughly of certain occupations, etc., and also has provided for entertainments of various kinds and maintains a trade-discount plan by which the members are enabled to obtain certain discounts from regular prices upon their purchases of groceries, etc., upon dealing with certain selected establishments.

From the standpoint of the evening classes this may be considered an industrial school. Certain occupations are quite thoroughly taught and seem to be within the scope of this report. They are as follows: Dressmaking, millinery, embroidery, and drawing and design. During the year ending April 1, 1900, the number of pupils in dressmaking was 40, in millinery 45, and in embroidery 50. No class in drawing and design was then in existence.

In these industrial classes there are 9 instructors. The management of the classes is in the hands of the officers of the Robert Treat Paine Association and the superintendent of the institute.

The annual cost of maintaining these classes approximates $1,000, and the funds are obtained from the association and from membership fees, which are only $1 per year per individual. This fee entitles the member to any or all the privileges of the institute.

These courses of instruction could be improved if there was more money to spend on them, but they are fairly complete as it is. They turn out many girls and women competent to work at dressmaking, millinery, etc., and certainly increase the ability and intelligence of their members. They are not fully satisfactory, as they do not go far enough, but good work has been done by them.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, NEW YORK, N. Y.

The Young Women's Christian Association of New York City was founded February 10, 1870. The object of the association, as stated in its charter, is "to promote the temporal, social, mental, moral, and religious welfare of young women, particularly those dependent upon their own exertions for support." Among the various methods and ideas which have been introduced into the work of the association, all of which have served a good purpose, none have proved so fruitful or satisfactory as the courses in industrial and trade work. During the earlier part of its career the educational work of the association was largely confined to the commercial branches, and very little interest was manifested in industrial education until the fall of 1886. Since that time, however, the industrial branches have continued to grow in

importance until now they overshadow all the other branches combined. In addition to the regular class work, the association conducts an employment bureau, and needlework and order departments. Many of the graduates have procured positions through the agency of the bureau. The needlework department has fitted up a large salesroom, which is stocked with all kinds of embroidery, lace and drawn work, fancy articles, and accessories for infants' and children's use. All articles are the work of self-supporting women, and all sales are for the benefit of the consignors. In the order department ladies' wrappers, shirt waists, and underwear, and misses' and children's dresses and cloaks are made to order at reasonable prices. The value of the articles disposed of in this department in the past year amounted to $12,000.

All pupils must be members of the association. The classes are open only to women studying for self-support. Pupils are admitted to the sewing and cooking classes at the age of 15. In the class for trained attendants no pupil is admitted under 20 or over 40 years of age, except by special agreement. In the other classes applicants must be between the ages of 18 and 35, and not connected with other schools. Satisfactory references are invariably required.

The charges for tuition are as follows: Hand and machine sewing, $2 to $4; dressmaking, $5 to $12; millinery, $5 to $7; feather curling, $2.50; embroidery, $7 to $9; cooking, $3 to $5; free hand and mechanical drawing, $15; instrumental drawing, $15; drawing in water colors, designing, etc., $9 each; course for trained attendants, $10.

The school year opens October 1 and continues until the 1st of June. Day and evening sessions are held. The curriculum includes thorough instruction in every detail of hand and machine sewing, dressmaking, millinery, art embroidery, feather curling, cooking, invalid cooking, and a course for trained attendants. The industrial-art course includes mechanical, free hand, cast, and life drawing, pen and ink work, crayon and water color, clay modeling, wood carving, design, etc.

The course for trained attendants is specially designed to qualify the pupils to serve as attendants in the care of convalescents, feeble or elderly persons, and subacute and chronic cases. This occupation, which is somewhat akin to that of a trained nurse, should not be confounded with the latter, as the course of study for a trained nurse covers a period of at least two years, while the course for a trained attendant lasts only eight weeks.

The school is under the management of a committee on education, which is appointed by the association. There are 13 instructors, all of whom have had practical training in their respective branches. There have been about 5,000 graduates. The number of pupils in the different classes during the past year was as follows:

ATTENDANCE IN CLASSES OF THE YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, NEW YORK CITY.

Classes.	Pupils.		
	Day.	Evening.	Total.
Hand and machine sewing	291	98	389
Dressmaking	208	90	298
Art embroidery	16	.....	16
Feather curling	38	6	44
Cooking	84	112	196
Invalid cooking	88	.....	88
Trained attendants	116	.....	116
Industrial art	63	18	81
Millinery	207	60	267
Total	1,111	384	1,495

The space devoted to school work takes up the greater portion of the association building, which is a five-story brownstone structure and, together with the equipment, is valued at $600,000. The funds for erecting and equipping the building were provided by donations and contributions from members of the association and prominent citizens. Several classes are self-supporting, and a large percentage of the cost of maintenance is derived from tuition fees. The balance is provided by the association. The entire cost of maintaining the association is about $50,000 per annum, of which amount more than one-half is chargeable to the courses covered by this report.

It is stated that many important modifications have been made in the original curriculum, with the result that the present courses of training and study are entirely adequate. It is impossible to specify the numerous benefits which have accrued from the introduction of the industrial courses. Speaking generally, the industrial features of the association's work are designed, before anything else, to improve and elevate the individual. Besides the thorough training given in each branch the pupils are taught to be diligent, ambitious, and self-reliant, and it is thought that with these attainments they are well qualified to engage in their chosen occupations, and that the resulting benefits to the industries in which they engage and to the community at large are sure to be of the very highest order.

Ample evidence of the benefits derived by those who have been under instruction was found on every hand. Many young women who could not command more than $5 or $6 per week in occupations usually restricted to their sex are now earning from $12 to $25 per week as the result of their training in the school. It is said that in almost every instance the graduates are able to enter upon practical work without serving a period of apprenticeship, and that they are preferred by employers over ordinary shop-trained help. The reason assigned is that besides being competent to do good work they are of a high moral character and are more reliable. The industrial courses have been a decided success and have more than achieved their

original purpose. To enable the woman who must be a breadwinner to win more than a place and a pittance, and so become a wise, womanly toiler, respected and capable, has been the aim of the educational department from the beginning. That this has been accomplished is perhaps best illustrated by the continued approbation which comes from the business men and employers and thousands of self-supporting women who have been benefited by the work of the school.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, BROOKLYN, N. Y.

The Young Women's Christian Association of Brooklyn, N. Y., was organized February 23, 1888. Excepting that the curriculum is not quite so extensive, the object of this association is precisely the same as that of the Young Women's Christian Association in New York City. The classes are nonsectarian, but all pupils must be members of the association. Any young woman over 15 years of age, of good moral character, may become a member of the association by paying an annual fee of $1. In addition to this a small tuition fee is charged. The school year opens about the middle of September and closes the middle of June. Day and evening sessions are held. The courses of instruction include plain sewing, dressmaking, millinery, art embroidery, cooking, and a course for attendant nurses. This latter course is similar to the course for trained attendants reported in connection with the Young Women's Christian Association School in New York City. There is also a normal course in cooking and a course for juniors.

The charges for tuition range as follows: Plain sewing, $1.50 to $3; dressmaking, $2.50 to $7.50; millinery, $2.50 to $5.50; millinery trade course, $30; art embroidery, $3 to $5; cooking, $1.50 to $4; course for attendant nurses, $3.

The school is managed by the educational committee of the association. There are 24 instructors, all of whom have had practical training in their respective branches. The number of pupils in the different classes during the past year was as follows:

ATTENDANCE IN CLASSES OF THE YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, BROOKLYN, N. Y.

Classes.	Pupils.		
	Day.	Evening.	Total.
Plain sewing	200	325	525
Dressmaking	400	125	525
Millinery	220	200	420
Art embroidery	20	15	35
Cooking	96	150	246
Attendant nurses	.....	22	22
Total	936	837	1,773

The record of graduates is incomplete, but it is estimated that at least 1,500 pupils have completed the different courses. The classes occupy 15 large rooms in the association building. It is estimated that the value of the property devoted to school purposes will amount to $100,000. The funds for erecting and equipping the building were provided by donations and contributions from prominent citizens and business men in the locality. The school is maintained partly by tuition fees and the balance is provided by the association. The cost of maintenance is about $18,000 per annum.

The present courses of training and study are considered satisfactory in every detail. It is stated that while the benefits resulting from the establishment of this school have been largely individual, nevertheless the dressmaking and millinery industries have derived considerable benefit from the fact that the school is constantly turning out a trained class of workers who engage in those industries. In the opinion of the officials, the school has accomplished a great deal of good in other directions also. It has helped to increase the intelligence and efficiency of the working women generally, and has always taken a prominent part in everything that tended to promote industrial, educational, social, and moral development in the community. The school is constantly receiving evidence of the benefits accruing to those who have been under instruction. While it can not be said that the graduates are preferred over shop-trained help, still in every case heard from thus far they encounter no difficulty in engaging in practical work after leaving the school, and they are reported to be proficient and reliable and are well liked by their employers. The school has attained the object for which it was established, its main purpose always being to dignify labor and to give deserving young women a chance to learn to do something that they can always rely upon for a livelihood.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION SCHOOL, HARLEM, N. Y.

The Harlem Young Women's Christian Association in New York City conducts a course in industrial training which is designed to meet the wants of young women who wish to learn a wage-earning occupation. From the time when the association was organized up to 1895 the interest in trade education did not amount to much. In the latter year, however, on account of the more frequent opportunities offered to those who had acquired a trade training, the value and importance of this kind of instruction became more manifest, and in consequence the interest in the several classes has been increasing every year since. The classes are nonsectarian, but all pupils must be members of the association. Any young woman of good moral character may become a member by paying an annual fee of $1. The school year opens in September and closes in June. Day and evening sessions are held.

The courses of instruction include plain sewing, dressmaking, millinery, embroidery and lace making, and feather curling.

The charges for tuition are as follows: Plain sewing, $2 per month; dressmaking and millinery, $2.50 to $3 per month; embroidery, $2.50 per month; feather curling, $4 for a full course. In all courses except feather curling a reduction of from $1 to $2 is made when the full course is paid for in advance.

The school is managed by the educational committee of the association. There are 4 instructors, all of whom have had practical training in their respective branches. The number of pupils in each class during the past year was as follows: Plain sewing, 39; dressmaking, 97; millinery, 60; embroidery and lace making, 8; feather curling, 8.

Six hundred pupils have completed the trade courses. The classes occupy 4 large rooms in the association building, which cost $80,000, and their share of the annual expenses is about $8,000. The school is maintained partly by tuition fees and partly by the association. It is stated that the courses of study are quite satisfactory, but at the present time the school is greatly in need of more space. If this could be had, a larger number of pupils could be accommodated and the scope of the work would be extended so as to embrace other branches which would be congenial to women wage-earners. Owing to lack of funds the prospect for acquiring more adequate accommodations is uncertain. While the officials feel that the school has accomplished a great deal of good in many directions, still the work has not been extensive enough to permit of tracing such benefits as may have accrued to any particular industry or to the community at large. It is stated that the effect upon those who have been under instruction has been extremely gratifying both to the association and the pupils. They are preferred over shop-trained help because they are competent and reliable, and, furthermore, are not required to undergo a period of apprenticeship before engaging in practical work.

The school has proved very satisfactory thus far, but it has not yet fully attained the end for which it was established. The association desires to extend the curriculum so as to include every branch of work that women can adopt for a livelihood. When this has been accomplished, the ultimate object will have been achieved.

WOMEN'S TRAINING SCHOOL, ST. LOUIS, MO.

This school was established in 1882 as a branch of the Young Women's Christian Association. Its object is to aid deserving girls and women by instructing them in stenography, sewing, dressmaking, millinery, cooking, general housework, and such other subjects as may assist them to earn a living.

While the prime object of the school is to instruct women that they may maintain themselves, still classes in cooking, dressmaking, plain

sewing, millinery, household management, and laundry work are arranged to accommodate any persons who may wish instruction, and charges are made to suit the financial condition of the pupil.

The rules and regulations of the school are such as to make it possible for every woman who really wishes instruction to receive it, and no person is refused admittance because of lack of money.

The school is under the direction of a board of managers. There are 6 teachers, each of whom is a graduate. During the year 1899 85 pupils received instruction in cooking, 19 in laundry work, 19 in household management, 86 in plain sewing, 47 in dressmaking, 48 in stenography, 48 in typewriting, 8 in millinery, and 10 in bookkeeping. In addition to this, teachers were sent to sister institutions where only one lesson per week was desired, and there instructed 67 in cooking, 75 in plain sewing, and 10 in dressmaking, thus giving a grand total of 522 for the one year.

The rental of the building is $100 per month, cost of equipment $1,500, and cost of maintaining and operating, approximately $5,000. These funds are raised by excursions, sale of lunches, tuition fees, entertainments, board, contributions, etc. For the past thirteen years from 200 to 400 women have lunched daily at noon at an average cost of 10½ cents per lunch, 100 to 250 women and girls have been boarded and lodged, hundreds cared for temporarily, employment found for other hundreds, and in eighteen years 4,500 have received instruction in the various departments.

The graduates are not only preferred, but they are paid better wages. The school has greatly improved and advanced in usefulness from the beginning, and the management hopes, at no distant day, to see the school have a building of its own suited to its needs and commensurate with its influence and usefulness.

ARMOUR INSTITUTE OF TECHNOLOGY, CHICAGO, ILL.

The department of domestic arts and science was organized at the opening of the institute in 1893. The increasing interest in social questions indicated that the time was ripe for instruction in the subjects allied to domestic economy. The aim of this department is not merely to impart the technical skill and knowledge so desirable to those who guide the home, but to train women to a broad, scientific view of the whole range of subjects allied to the proper management of the home. There is a demand for teachers in this line, and special opportunities are now offered to those who desire to become teachers.

There are special and technical courses in plain sewing which prepare students to enter the courses in dressmaking. The regular course in dressmaking is arranged to give the pupils a practical knowledge of cutting and fitting for home use. The course in technical dressmaking is for those who wish to become dressmakers and

can devote their whole time to this study. Applicants must be over 18 years of age and must pass a preliminary examination in hand and machine sewing. No applicant is received for less than one year.

The course of study embraces drafting; study of the human form as applied to dress; making skirt and waist of plain material; cutting, fitting, and stitching waist of plaid or striped material; making fancy waists; renovating materials, ribbons, and laces; making over dresses; tailor buttonholes; bow making; princess dress; children's dresses; evening waist; making tailor-finished dress; the art of designing new styles, and of combining colors; summer toilets. The full course covers three terms, and the charges are $20 per term.

Besides special courses in cookery, designed for housekeepers and nurses, a special class has been formed in cookery for those who desire to become cooks in private families. No others are admitted. The course includes twelve lessons and is completed in one term of three months. Each lesson is of two and one-half hours duration. No requirements for admission are necessary and no examinations are held. The work embraces plain and fancy cooking adapted to the needs of cooks. The work is repeated each term. The charge is $5 for the term.

Thirteen instructors are employed in this department.

Many of the students from this school hold good positions at good wages. They are preferred by employers because they understand better the reasons for doing things. The work of the school has been very popular and highly satisfactory. The management has good reason to be pleased with the work done. The effort is being made to meet the practical needs of society.

The other courses of instruction in the school are not within the scope of this report.

HEBREW TRADE SCHOOL, PHILADELPHIA, PA.

The Hebrew Trade School in Philadelphia was established by the Hebrew Education Society in 1883. The following statement regarding the purpose and work of this school was furnished by the secretary of the organization: The need for a school of this kind arose from the fact that there was a large and constantly increasing number of young men and women of Hebrew descent in the city who were unfitted to obtain remunerative employment. The purpose of the school is to give the pupils such a knowledge and training in the trades taught as will enable them to take up and follow some occupation for a livelihood. The school is open to both Jew and Gentile and the instruction is free to all. New pupils are admitted whenever there is any vacancy in the classes. Prizes to the amount of $400 are awarded annually to the pupils showing the highest degree of proficiency.

The courses of instruction include dressmaking, millinery, garment

cutting, and cigar making. In addition there are junior classes in plain sewing, carpentry, and free-hand drawing, and classes in elementary arithmetic and English. The school is open for instruction four nights each week during the entire year from 7 to 9 p. m.

The period of instruction is indefinite. All pupils are first instructed in the use of tools and materials and advanced from one stage to another until they are proficient and able to obtain employment in the trade they have learned. It usually requires about one year to reach this point. In dressmaking the pupils are taught to draft the patterns before taking up cutting and making; the millinery class first learn to make the hat frames before taking up body making and trimming; in garment cutting the preliminary work of measuring the cloth and laying out patterns for various garments is followed by the cutting, using heavy paper at first and in the latter stages cloth, and in cigar making the work of stripping, bunching, and rolling is taught in regular order.

The school is under the general management of the Hebrew Education Society of Philadelphia. There are 4 instructors in the trade work, all of whom are experts in the parts they teach and are actively engaged in the trades. The pupils are coming and going all the time, and therefore there are no fixed grades. The number of pupils in the several classes in April, 1901, was as follows: Dressmaking, 20; millinery, 15; garment cutting, 20; cigar making, 30. About 600 pupils have completed the different courses. The trade classes occupy five rooms, which have an aggregate floor space of 3,600 square feet. The school building was erected and equipped in 1883, at a cost of $52,000, the funds for the purpose being provided by subscriptions from members of the society. The value of the part devoted to the trade school is estimated to be $17,000. The revenue of the school is derived from an endowment fund, legacies, and subscriptions from members of the society. The cost of maintenance for the trade school is about $3,000 per annum.

The present courses of training and study are satisfactory, though other trades will be added to the curriculum when the revenue of the society will permit. The school, being located in a densely populated section of the city, has been a great benefit to a large class of young people whose spare time might otherwise be wasted. It affords a place for young men and women to spend their evenings in learning to do something that will enable them to earn a respectable living. It keeps them from the streets, and they have less time to spend in harmful or useless recreation. There can be no question but that the school has increased the intelligence of its pupils, and that it has helped to promote the industrial, educational, and social development of the community. During the early history of the school it was opposed by local labor unions on the ground that it turned out a cheap class of

workmen, who interfered with the opportunities of the "union men." Experience shows, however, that the opposition was not well founded, for in the particular trade which claimed to be affected there were not enough graduates or pupils to have any influence whatever upon the wages or work of the regular workmen.

The effect upon those who have been under instruction has been beneficial in every respect. The training they have received has made it possible for them to enter the trades and earn good wages, and many of them are now holding good positions. In some trades it is possible for graduates to engage in practical work without serving an apprenticeship. In others they start in as helpers. The school has proved satisfactory and has practically attained the end for which it was established.

S. T. TAYLOR DRESS-CUTTING AND DRESSMAKING SCHOOL, NEW YORK, N. Y.

This school was originally established in New York City in 1848. Like many of the dressmaking schools which are to be found in different parts of the country, the primary purpose here was to give instruction in drafting and cutting women's apparel according to a special system originated by the founder of the school. Owing to constant demands for instruction in other branches, a course in dressmaking was added to accommodate those who were desirous of taking up the trade for a livelihood.

The school is open the year round, and pupils are admitted at any time. Three weeks is the average time required to learn the drafting and cutting system, though the pupils are at liberty to take as many lessons as they desire up to the period of six months, which is the limit of instruction in this course. The course in dressmaking contains 15 lessons of two hours each and must be completed within four weeks from the time of commencement. Both courses are said to be complete in every detail. All pupils receive individual instruction and every precaution is taken to assure practical results.

There are 5 instructors, whose training was obtained in practical work. Six hundred pupils received instruction during the past year, and since the school was opened there have been about 8,000 graduates. The equipment is valued at $1,000. The school is maintained by tuition fees, and the cost of maintenance is $7,500 per annum.

It is stated that the dressmaking industry has derived considerable benefit from the establishment of this school, and that the instruction received by the pupils has been most valuable to them. It has increased their efficiency and enabled them to obtain steadier employment and higher wages. Those who take up the trade as wage-earners have no trouble in obtaining good positions. They are preferred over ordinary shop-trained dressmakers, because, having had the advantage of a systematic course of training, they are better qualified for doing all kinds of work.

M'DOWELL DRESS-CUTTING, DRESSMAKING, AND MILLINERY SCHOOLS.

The McDowell schools, which are to be found in a number of the larger cities, were originally established for the purpose of giving instruction in drafting, cutting, and fitting women's garments. The success met with in this direction finally led to the introduction of courses in dressmaking, and in a few of the schools a course in millinery was also added. The schools in New York City, Chicago, and Philadelphia being under the same general management, the rules, methods, and courses of instruction are practically the same. The schools in New York City and Chicago were established in 1891, and the school in Philadelphia in 1896.

All the schools are open the entire year and pupils can enter at any time. The hours for instruction are from 9 a. m. to 5 p. m. Evening sessions are also held three evenings each week from 7 to 9.30 p. m. Individual instruction in all parts of the work is given either in German, French, or English. No limit is placed upon the time for completing the courses. Once a person becomes a pupil she has the privilege at any time of returning for instruction upon new styles.

The courses are arranged to meet the requirements of those who have already learned one or more branches of the trades, but who desire further instruction upon certain points, as well as those who have no knowledge of either trade. It is stated that the necessary time for acquiring a thorough knowledge of cutting and fitting by the system employed is about ten days. In the dressmaking department dressmakers stay from one to three weeks, according to the information they desire, while the young women who take up the work as beginners generally spend about two months in completing the course. The full course in cutting, fitting, and dressmaking for beginners usually requires about three months. The schools are under the general management of the founder. All the instructors have had years of practical experience in ladies' tailoring, dressmaking, and millinery. The number of instructors in the New York City school is 8, in the Chicago school 6, in the Philadelphia school 4. The average number of pupils in the different classes during the past year was as follows:

ATTENDANCE IN McDOWELL DRESS-CUTTING, DRESS-MAKING, AND MILLINERY SCHOOLS.

School.	Cutting and fitting.	Cutting, fitting, and dressmaking.	Millinery.	Total.
New York City	300	150	200	650
Chicago	200	100	150	450
Philadelphia	150	75	100	325
Total	650	325	450	1,425

The New York school has had 4,500 graduates, the Chicago school 3,000, and the Philadelphia school 1,000. The value of the equipment in each school is as follows: New York City $2,000, Chicago $1,000, Philadelphia $1,000. The schools are maintained by tuition fees. The cost of maintenance during the past year was as follows: New York City $8,500, Chicago $6,000, Philadelphia $4,000.

It is stated that in addition to the benefits accruing to experienced dressmakers who have received special instruction in cutting and fitting these schools have turned out large numbers of practical and well-trained young women, whose services and talents have been employed with great advantage to the dressmaking and millinery industries of the country. The effect upon those who have been under instruction is said to have been beneficial in every respect. A majority of the young women who enter the school have no knowledge whatever of practical work. After completing the course of instruction they are fitted to engage in the ordinary work of the trades and have little difficulty in procuring good positions. In most cases their better general preparation for all-round work gives them preference over shop-trained help. It is claimed that little attention is given to systematic training in the average dressmaking or millinery establishment, and that this fact is attested by the number of young women who have been employed in those establishments, but who come to the school for thorough instruction in all branches of the trades.

MITCHELL SCHOOL OF GARMENT CUTTING, NEW YORK, N. Y.

The Mitchell School of Garment Cutting was established in New York City in 1873. It is stated that when this school was opened the schools then in existence were not based upon such principles as were productive of the best results, either to the industry represented or to the graduates. The trade generally was in need of men who possessed the ability to cut and fit any and all kinds of garments. It was with the view of supplying this want that this school was established.

The curriculum is arranged to meet the requirements of three classes of pupils: First, those already skilled in garment cutting, but who are desirous of learning a more modern and systematic method. Second, those who are not skilled in garment cutting, but who are merely sewing tailors. Third, those who are neither tailors nor cutters, but who wish to learn the trade of garment cutting. The school is open the year round and pupils are admitted at any time. The hours for instruction are from 10 a. m. to 4 p. m.

The course of instruction includes two distinct systems for cutting men's garments, namely, the short-measure or standard system, which requires 136 lessons, and the long-measure or Madison's system, which requires 184 lessons. In addition to these there is a complete modern

system for cutting women's tailor-made garments. Besides the individual instruction which is given, the technical points, measurements, etc., are fully explained by illustrated text-books which are specially designed and used for that purpose.

The school is under the general management of the John J. Mitchell Company, publishers of fashion plates. There are 6 instructors, all of whom have been actively engaged in the various branches of tailoring and whose education and experience fits them for the work. One hundred pupils attended the school during the past year, and since it was first opened there have been upward of 3,000 graduates. The school occupies the entire floor space of a room that is 184 by 60 feet, and the equipment, which is valued at $5,000, is complete in every detail. It is maintained by tuition fees, and the cost of maintenance is $15,000 per annum. The curriculum is revised from time to time to meet changed conditions in the trade.

It is stated that by teaching the simplest, most modern, and improved methods in garment cutting the merchant tailors and the clothing industry generally have been greatly benefited. The school has turned out hundreds of well-trained and capable garment cutters and designers through whose artistic knowledge and application the manufacture of clothing has been brought to a high degree of perfection. Strong evidence of this is attested by the graduates now in business for themselves, and also by the fact that a great number are filling high-salaried positions in leading establishments throughout the country. It is said that the school has been recognized as valuable to the workingmen in the clothing industry, and has received the moral support of labor unions, many members of which have attended the school. The effect upon those who have been under instruction has been of the most beneficial character. Their sytematic training gives them an advantage and preference over the ordinary shop-trained workmen, and from the time of their graduation they engage in practical work without undergoing a period of apprenticeship. They have secured better and steadier employment, higher compensation, and their opportunities for advancement are invariably assured. The school has proved satisfactory, and has far exceeded the anticipations of its founders.

Besides the schools already described there are a number of others of more or less importance in which technical and trade instruction of this class is given. The majority of these schools are located in New York City, and in many instances the work of instruction is conducted by one person, usually the proprietor of the school, who has originated some special system by which instruction is given to beginners in certain trades and technical principles are made clear to those already engaged in the same. As the instruction in these

schools relates to occupations and trades which have already been fully covered in representative schools, it is hardly necessary for the purpose of this report to go further into the subject than to mention some of the different schools of this class. They are as follows: American School of Garment Cutting; Koone's Garment Cutting School; Englemann's Garment Cutting and Designing School; Italian Garment Cutting Academy; Hecklinger's Institute of Practical Garment Cutting; Tailors' Review Garment Cutting School; Taylor's Dresscutting and Dressmaking School; Pascal Institute Dressmaking School; Pinsuti Garment Cutting School; Cullen's Millinery and Dressmaking School; Vienna Dressmaking and Millinery Institute; Educational Alliance School, with courses in millinery, plain sewing, dressmaking, art needlework, and cooking; Clara de Hirsch School, with courses in cooking and general domestic work. All the foregoing schools are in New York City. Buffalo has a training school for nursery maids, and the Women's Educational and Industrial Union of that city conducts courses in millinery, plain sewing, dressmaking, cooking, and general domestic work.

Outside of New York State may be mentioned the Chas. J. Stone Company Cutting School at Chicago, Mrs. Leisler's Dresscutting and Dressmaking School at Cincinnati, the Cleveland Cutting School at Cleveland, and Keister's Ladies' Tailoring College and the St. Louis Millinery College at St. Louis.

TEXTILE SCHOOLS.

Textile schools in this country owe their beginning to the Philadelphia Textile Association. The manufacturers of textiles were aware of the work of the foreign textile schools and became convinced that with such schools in this country competent designers and textile experts could be trained and that the highest grades of goods could be made here as well as in any foreign mill. As a result a textile department was added to the Pennsylvania Museum and School of Industrial Art in 1884. The school was successful from the start. It has gained the approval and generous support of the manufacturers of textiles and of textile machinery. The State and city have given it generous financial aid, the appropriation for the latest year being $17,500 from the former and $10,000 from the latter. Free scholarships are granted in return.

Nothing more was done for textile education until 1895 (if we except the important work in design of the Lowell School of Practical Design in Boston, which was founded in 1872). In that year the textile interests of Massachusetts secured the passage of an act authorizing the establishment of textile schools in cities with 450,000 spindles or over, and granting State aid to the extent of $25,000 in case the municipality appropriated an equal amount. This act was applicable to Lowell, Lawrence, Fall River, and New Bedford. The management was to be

in the hands of from 7 to 20 trustees, 2 of whom should be the mayor and the superintendent of schools and 2 were to be appointed by the governor.

The first school created under the act was the Lowell Textile School, opened in January, 1897. New Bedford followed with a school devoted especially to cottons, in October, 1899, and action was taken for a school in Fall River in 1900. This is now called the Bradford Durfee Textile School of Fall River. All these schools have received aid from the State, the amounts voted in 1901 being: For Lowell, $35,000 for a building, the amount to be duplicated from the city or other sources, and $18,000 for the year's expenses on condition that $7,000 be raised by the city or from other sources; for New Bedford, $18,000, on condition that $7,000 be raised by the city or from other sources; for Fall River, $35,000 for a building, the amount to be duplicated from the city or other sources. A condition that has been made in all these schools is that regular day students who are nonresidents of the State must pay a yearly tuition of not less than $150.

In the South several schools have introduced textile courses with encouraging results. These are Clemson College, South Carolina, in 1898; the North Carolina College of Agriculture and Mechanical Arts, in 1899, and the Mississippi Agricultural and Mechanical College, in 1900. A description more in detail of some of the schools is given in the following pages.

PHILADELPHIA TEXTILE SCHOOL AND SCHOOL OF INDUSTRIAL ART, PHILADELPHIA, PA.

The Pennsylvania Museum and School of Industrial Art owes its origin to the increased interest in art and art education awakened by the Centennial Exhibition in Philadelphia in 1876. It was incorporated February 26, 1876, for the purpose, as stated in the charter, of establishing "for the State of Pennsylvania, in the city of Philadelphia, a museum of art in all its branches and technical applications, and with a special view to the development of the art industries of the State, to provide instruction in drawing, painting, modeling, designing, etc., through practical schools, special libraries, lectures, and otherwise."

The purpose of the institution as thus defined is distinctly industrial. It was determined by the founders to make the collections for the museum as largely as possible illustrative of the application of art to industry, and the instruction in the school has constant reference to a similar purpose.

Pending the incorporation of the institution, a fund of $25,000 was subscribed with which to make purchases at the exhibition. Around the nucleus thus formed the museum has grown, by purchase, gift, and bequest, to its present proportions, numbering in its collections upward of 10,000 objects. The major part of the collection of the products and manufactures of British India shown at the Centennial

Exhibition was presented to the museum by the British Government at the close of the exhibition.

The school was opened during the winter of 1877–78, and up to 1884 the work of the classes was confined to general courses in drawing, painting, and modeling, with constant regard to the needs of the industries, but without attempting to provide instruction in any particular occupation.

The necessity of affording facilities for technical instruction became apparent very early in the history of the school. It was seen that only by familiarizing the students with the processes and industrial applications of design could the proper direction be given to such purely artistic training as the school had to offer. Accordingly, in 1884, a school of applied design, a school of wood carving, and a school of textile design and manufacture under the name of the Philadelphia Textile School, were organized.

In the meantime the scope of the institution has been considerably enlarged, and under the present organization schools are in active operation in applied art (drawing, applied design, wood work and carving, decorative painting, illustration, decorative sculpture, and architectural design), in normal instruction, in modern languages, and in textile design and manufacture. In the latter school instruction is given in fabric structure and design, weaving, color harmony and figured design, chemistry and dyeing, wool carding and spinning, worsted drawing and spinning, cotton carding and spinning, and finishing. In addition to these there is a department of worsted yarn manufacture in process of development.

The textile school represents the most important effort which has yet been made in America to organize the instruction in an art school with direct reference to its application to the actual needs of the textile industry. The development and realization of this purpose were accomplished through the cooperation and support of members of the Philadelphia Textile Association. This association, formed in 1882, had kept prominent among the objects for which it was created the fostering of technical education. Its members represented the manufacturing community of Philadelphia and vicinity. They were fully aware of the progress of technical schools for the textile arts in Germany, France, and England, and believed that the United States could not hope to maintain the best market for its products unless these products combined the highest skill in manufacture and best taste in design. At that time no school of like character existed in this country, and it was necessary to begin at the foundation of the work, without previous knowledge of the exact methods to be adopted or the means to be employed to reach the desired end.

In consideration of an annual appropriation to the school by the legislature of Pennsylvania each county in the State is entitled to at least one free scholarship in any department of the school for the full course

of three years. Counties sending more than one senator to the legislature are entitled to as many scholarships as there are senatorial districts. These appointments are made by the governor of the State, usually on the recommendation of members of the State legislature. In addition to the above there are seventeen free scholarships, which are offered to pupils in the public schools of Philadelphia. The school year opens the latter part of September and closes the first week in June. Day and evening sessions are held. The hours of study for day classes are from 9 a. m. to 4 p. m., with one hour for lunch, every week day except Saturday. On Saturday there is a forenoon session in the textile school and a session for special pupils in the school of applied art. The evening classes in the textile school are in session from 7.30 to 9.30 o'clock three evenings in the week. The evening sessions in the school of applied art are arranged so as to cover six nights in the week.

Applicants for admission are expected to have an ordinary grammar-school education, in addition to which a good knowledge of free-hand drawing is desirable for admission to the textile school, though this is not insisted upon. The work of each school is arranged so as to admit of special courses of one or two years' duration. The regular courses require three years for completion.

The tuition fees in the day school are $150 per year of thirty-six weeks for all courses except the ingrain-carpet course, which is $75. There are also additional laboratory charges of from $3 to $5 per year.

In the evening school the fees are $25 per year for the course in general analysis and technical chemistry, and $15 for either one of the other courses.

The institution is managed by a board of trustees and an associate committee of women. A part of the trustees are elected by the members of the corporation, and a part appointed by the State legislature and by the city government. There are 36 instructors, a considerable number of whom have been trained in the school. The instructors are always chosen for their experience in practical work in connection with the industries for which the school is intended to be a preparation. The number of pupils during 1900–01 was as follows:

ATTENDANCE IN TEXTILE SCHOOL AND SCHOOL OF APPLIED ART OF THE PENNSYLVANIA MUSEUM, 1900–01.

Department.	First year class.	Second year class.	Third year class.	Total.
DAY SCHOOL.				
Applied art	274	74	34	382
Textile design and manufacture	65	30	13	108
EVENING SCHOOL.				
Applied art	206	31	25	262
Textile design and manufacture	122	36	21	179
Total	667	171	93	931

In addition to the above there were 70 pupils in the classes in modern languages. The total number of graduates to date (1901) is 1,257.

The funds for erecting the buildings, which, together with the equipment, are estimated to be worth $1,200,000, were provided by subscriptions, gifts, and bequests from public-spirited citizens, manufacturers, and business men of Philadelphia and vicinity. A considerable portion of the equipment was purchased and donated outright by textile manufacturers. The revenue of the school is derived from an annual appropriation of $17,500 by the State legislature, an annual appropriation of $10,000 by the city of Philadelphia, income from endowments, and tuition fees. The cost of maintenance, including interest on mortgaged property, is about $65,000 per annum.

It is the policy of the management to keep the equipment up to date. Whenever it is seen that new apparatus will assist in the demonstration of a subject that apparatus is obtained, and when an important improvement is made in machinery it is adopted by the school. In this manner the institution has kept apace with the developments of the times, and has been able to maintain a modern and thorough system of instruction in every department.

The aim has been not only to found a school equipped with the best apparatus possible, but to place that equipment in the hands of instructors who are able to handle it and produce the best results. It has been a principle of the management that the strength of the school rested not upon apparatus alone, but that the man is superior to the equipment, and that, first and foremost, it is necessary to have teachers rather than machinery. As the most perfect work of the teacher is obtained through the assistance of the best machinery, it has been the aim of the school to supplement one with the other.

The appreciation of the work of the school on the part of the manufacturers is evidenced by their generous gifts of the splendid equipment of machinery with which it is supplied and which is claimed to be "the most complete set of apparatus possessed by any school in the world."

The annual report of the trustees states:

It is pleasant to note the influence of these trained workers upon the products of the looms of our country. Everywhere there are evidences of the most conclusive character that there are no stronger minds at work to-day in the textile world than those that have received more or less of their education at our hands. New concerns have grown up, equipped and conducted by our own pupils; old ones have had their methods modified by the influences that have been brought to bear until they may be said to have renewed their youth under the influences which have passed from our school to their workshops. No State has been so largely benefited by the work in which we have engaged as our own. Several noteworthy enterprises recently established and conducted entirely by our pupils are distinct advances upon the lines that already existed in the manufacture of certain

specialties. There are noted instances of this in the various textile lines—cotton, woolen, and silk all being included.

The regard in which the school is held by the manufacturer is further attested by the following quotations from resolutions adopted by the National Association of Manufacturers and the New England Cotton Manufacturers' Association:

The National Association of Manufacturers, having visited in a body the School of Industrial Art of the Pennsylvania Museum and inspected its various departments, desires to place on the minutes of the proceedings of this convention an expression on the part of the convention of gratification in finding so extensive and well-equipped a technical school, of the high character of its results as shown in the finished work of the students, and its indorsement of its plan, purpose, and scope. We recognize in this school a most powerful factor for producing from the ranks of our youth earnest, industrious, and intelligent citizens, whose influence will be to strengthen the State.

Resolved, That the New England Cotton Manufacturers' Association has studied with the greatest interest the work of the Pennsylvania Museum and School of Industrial Art, including the Philadelphia Textile School, and desires to record in this way its high appreciation of the important service which this institution is rendering to the cause of American industrial development. We feel that among the agencies which it is the worthiest aim of such associations as ours to promote and support industrial education is of the first importance, and we warmly commend the spirit in which this magnificent school is conducted and the methods which characterize its teaching.

Resolved, That no better use can be made of public funds, of private munificence, or of the power that results from association than in the most liberal support of such institutions as the Pennsylvania Museum and School of Industrial Art.

Regarding the effect upon those who have been under instruction, it is said "the school has reached the operative class of the city and has been a great benefit to them. The night classes, which constitute a large part of the attendance, are composed almost entirely of working men and women. To these, as well as many others, the school has been the means of opening useful and honorable careers. The benefits, however, have not been confined to graduates alone, for a large proportion of those who did not complete the full courses have been enabled to obtain better and higher positions because of the knowledge and training they received in the school."

The report of the president states:

It is now no uncommon thing for our earlier graduates to make inquiries at the school for assistants that may be needed in the departments in which they are engaged—this is a matter of almost everyday occurrence. This of itself shows that the successful ones who have passed beyond the theoretical part of the work into the actual business of life fully understand the influence which our school has had upon them, and believe in its force and vitality, when called upon to supplement their own endeavors, by securing the help of other people.

Almost invariably these applications have been sent to the school for the purpose of obtaining our pupils to assist them in the development of their enterprises.

It is also a common thing for advertisements to appear in our technical papers asking for skilled help and stating that "graduates of the Philadelphia Textile School are preferred." This indicates the character with which the name of our school is associated.

The courses of instruction are as follows:

SCHOOL OF APPLIED ART.

Drawing from models, casts, draperies, still life, and the living model; lettering, geometrical drawing, with special reference to the laying out of ornament; projections, with their application to machine construction and to cabinetwork and carpentry; shadows, perspective, architectural drawing and design, painting in water colors, modeling and casting, historic ornament, decorative painting, use of tools in wood, metal, glass and leather work; illustration, original design for all classes of printed and woven fabrics, pottery, glass, metal work, etc. The instrumental drawing is taught by means of class lessons or lectures, and lectures are also given on anatomy and historical ornament, upon which examinations for certificates are based.

TEXTILE SCHOOL.

Regular course.

First year: Weave formation; analysis and structure of fabrics; color harmony; free-hand drawing and principles of figured design; mechanical drawing; Jacquard design; warp preparation and weaving; chemistry; carding and spinning; miscellaneous lectures.

Second year: Weave formation; analysis and structure of fabrics; Jacquard sketching, design, and coloring; wool and worsted spinning; machine drawing; warp preparation and weaving; chemistry; dyeing; wool and worsted cloth finishing; miscellaneous lectures.

Third year: Weave formation; analysis and structure of fabrics; Jacquard sketching, design, and coloring; spinning wool, worsted, or cotton; warp preparation and weaving; chemistry; dyeing; worsted and woolen cloth finishing; miscellaneous lectures.

Cotton course.

First year: Weave formation; analysis and structure of fabrics; color harmony; free-hand drawing and principles of figured design; mechanical drawing; Jacquard design; carding and spinning; machine drawing; warp preparation and weaving; chemistry.

Second year: Weave formation; analysis and structure of fabrics; warp preparation and weaving; Jacquard sketching, design, and coloring; carding and spinning; dyeing.

Wool and worsted course.

First year: Weave formation; analysis and structure of fabrics; chemistry; color harmony; mechanical drawing; principles of the Jacquard machine; wool and worsted spinning; warp preparation and weaving.

Second year: Weave formation; analysis and structure of fabrics; wool and worsted spinning; machine drawing; warp preparation and weaving; dyeing; woolen and worsted cloth finishing.

Silk course.

First year: Weave formation; analysis and structure of fabrics; color harmony; free-hand drawing and principles of figured design; mechanical drawing; Jacquard design; warp preparation and weaving; chemistry; miscellaneous lectures.

Second year: Weave formation; analysis and structure of fabrics; Jacquard sketching, design, and coloring; warp preparation and weaving; chemistry; dyeing; miscellaneous lectures.

Chemistry and dyeing course.

The course in chemistry and dyeing covers a period of two years, and is calculated to fit the student to know when a dyeing plant is properly administered. Instruction is given in a practical way and the student learns to know the dyeing powers and the commercial values of the various dyestuffs and chemicals used in dyeing establishments. His eye is trained in color matching, and the chemistry of the subject is entered into thoroughly, so that the student may test and know the real values of prospective purchases of chemicals and dyestuffs.

Ingrain-carpet course.

In this course one year is devoted to ingrain designing, together with the study of the machine and the effects produced by it, card cutting, and weaving.

Instruction is provided in French, German, Italian, and Spanish at hours which interfere very slightly with the work of the other classes. To students who have paid the full fee for the year no extra charge is made for this instruction.

In the courses taught in the evening schools the aim is to cover in a general way what is given in the day classes. The shortness of the time, however, renders it impossible to treat exhaustively any particular branch, and it is expected that the instruction given in the classes will be supplemented by a considerable amount of home study.

LOWELL TEXTILE SCHOOL, LOWELL, MASS.

This school was incorporated "for the purpose of establishing and maintaining a textile school for instruction in the theory and practical art of textile and kindred branches of industry." The incorporators were representatives of the great textile corporations of Lowell, Lawrence, and vicinity, whose aggregate capital is over $65,000,000. By the terms of the by-laws at least three-fourths of the trustees must be "persons actually engaged in or connected with textile or kindred manufactures." This was to insure the practical character of the management and the instruction.

The school was formally opened January 30, 1897, and instruction was begun February 1, 1897. The real need for such a school was to better the output of the mills in the Northern States. On the one hand, in cotton manufacturing, the mills of the Southern States could produce cheap grades of cloth at less cost than the Northern mills, and on the other hand the English mills could produce and sell in the United States the higher grades cheaper than it could be done by the

Northern mills. The English and other foreign mills could also make the finest grades of woolen and worsted goods cheaper than they could be produced here. Consideration of these facts led the manufacturers of the North to believe that eventually they would have to abandon the manufacture of the cheaper grades of cotton goods and confine themselves to making the better grades, and they also thought that they ought to be able to compete in the production of the finest grades of woolens and worsteds. In the manufacture of these materials, fine cotton and woolen and worsted goods, the competition of the foreign mills had to be overcome in order to attain success, and in order to do this it was necessary to learn how to produce the higher grades of cottons and woolens and to do it at least as cheaply as the foreign mills.

A prime essential for the accomplishment of this end seemed to be to raise up and train in this country a corps of men with the highest technical knowledge. This is the real purpose of the textile schools in Massachusetts; and while this school furnishes opportunity for the weaver, the spinner, the mechanic, etc., to learn his trade, yet the great object is to make a technical school where young men may be drilled in the science of the great industries and whose graduates will be the manufacturers, the engineers, and the inventors of the future.

As an example of the increase in value which skill and science will give in the textile industries, it may be stated, as being approximately true, that a pound of raw cotton worth 10 cents will, when made into ordinary cloth, be worth 19 or 20 cents, into better cloth $1, and when made into the finest grade of mull, ornamental in design and color, it will be worth from $8 to $12.

There are 18 instructors in the school, whose duties and training are as follows: The principal and professor of mechanical engineering, a graduate of the Massachusetts Institute of Technology, for two years an instructor in that institution, and for three years superintendent of a cotton mill; a professor of textile design and fabric structure, a graduate of an English trade school, and a practical mill operator in America and England; a professor of chemistry and dyeing, a graduate of Lehigh University and of Brown University; a head instructor in warp preparation and weaving, a practical training in mills; a professor of decorative art, a training as an artist in the Paris École des Beaux Arts; a professor of mathematics and head instructor in woolen and worsted spinning, a graduate of the Massachusetts Institute of Technology, and with a practical training in mills; a head instructor in cotton spinning, a college preparatory course and with a practical mill training; an instructor in mechanical engineering, a graduate of the Massachusetts Institute of Technology and for some years a mill draftsman; an instructor in chemistry, a graduate of the Worcester Polytechnic Institute; an instructor in woolen and worsted spinning and

finishing, a graduate of the Lowell Textile School and with a practical mill training; an instructor in the hand-loom department, a graduate of the Lowell Textile School and with practical mill training; an instructor in chemistry, a graduate of the Massachusetts Institute of Technology; an instructor in designing; an instructor in cotton spinning; an assistant instructor in free-hand drawing, a graduate of the Lowell Textile School; an assistant instructor in chemistry; an assistant instructor in power weaving, and an instructor in charge of modern languages. In addition there are several lecturers on mill engineering, one a former army officer, a civil and mechanical engineer, and an expert on water damages of the Metropolitan Water System of Massachusetts.

The equipment of the school consists of high-grade machinery, with all latest improvements, specially built to afford facilities for all kinds of experimental work, and of such variety as is never found in any one textile mill. With the machinery already installed, the school claims to have a more extensive equipment than any other existing textile school, either in America or Europe. It is as follows:

The equipment of the cotton-spinning department includes one automatic feeder, one single-beater breaker, and one single-beater finisher, made by the Kitson Machine Company, Lowell, Mass.; one top flat card and one revolving flat card, made by the Lowell Machine Shop, Lowell, Mass.; card-grinding rolls, stripping rolls, etc.; one silver lap machine and one comb, made by the Mason Machine Works, Taunton, Mass.; one railway head, one drawing frame, one slubber, one intermediate, one fine frame, one ring-spinning frame, one spinning mule, and one spooler, made by the Lowell Machine Shop, Lowell, Mass.; wet and dry twister, made by the Draper Company, Hopedale, Mass.; one reel, made by the Whitin Machine Works, Whitinsville, Mass.; one 50-saw gin; one Prior roller gin.

The woolen-spinning department includes one Parkhurst burr picker, made by the Atlas Manufacturing Company, Newark, N. J; one mixing picker, made by the Davis & Furber Machine Company, North Andover, Mass.; one set of three woolen cards, including: First breaker, with Bramwell feeder; second breaker, and finisher, made by the Davis & Furber Machine Company, North Andover, Mass.; one improved breaker feed and one Bramwell first-breaker feed, made by G. S. Harwood & Sons, Boston, Mass.; one Torrance balling head and creel, made by the Torrance Manufacturing Company, Harrison, N. J.; Apperly feed, made by G. S. Harwood & Sons, Boston, Mass.; one spinning mule, 120 spindles, and one twister, made by the Davis & Furber Machine Company, North Andover, Mass.; one Roy grinding frame and one Roy transverse grinder, made by B. S. Roy, Worcester, Mass.

The worsted-spinning department includes one 50-inch double worsted card (4 lickerin), made by the Davis & Furber Machine Company, North Andover, Mass.; one each of the following, made by Prince, Smith & Son, Keighley, England—revolving creel for 12 balls, double-head can gill box, 2-spindle gill box, 2-spindle drawing box, 2-spindle weigh box, 4-spindle finisher, 12-spindle dandy rover, 12-spindle cap spinner, 12-spindle flyer spinner, 12-spindle ring spinner, 12-spindle 2-fold cap twister, 12-spindle 6-fold ring twister; from Hall & Stell, Keighley, England—one gill box before combing and one gill box after combing; from Crompton & Knowles, Worcester, Mass.—one Noble worsted comb and one balling box; one 6-head universal winder, for cones and tubes.

The cotton-warp preparation department consists of one spooler, one warper, and one slasher, made by the Lowell Machine Shop, Lowell, Mass.; one beamer, made by T. C. Entwistle, Lowell, Mass.; drawing-in frames, etc.

The woolen and worsted warp-preparation department consists of one warp spooler, one dresser, one reel, one beamer, and one 48-spool creel, made by the Davis & Furber Machine Company, North Andover, Mass.; also a number of hand warping and beaming frames.

The weaving department, which is the most complete in the world with regard to the variety of looms, consists of one plain Northrop loom, made by the Draper Company, Hopedale, Mass.; one plain print-cloth loom, and one side-cam twill loom, made by the Whitin Machine Works, Whitinsville, Mass.; one 5-harness heavy loom, made by the Lowell Machine Shop, Lowell, Mass.; one plain print-cloth loom, made by the Mason Machine Works, Taunton, Mass.; and the following looms made by the Crompton-Knowles Loom Works, Worcester, Mass., and Providence, R. I.—one Knowles gingham loom, 4 boxes; one Knowles fancy-cotton loom, with 20-harness dobby, 4 boxes; one Knowles fancy-cotton loom, with 25-harness dobby; one Knowles blanket loom, with 25-harness dobby, 4 boxes; one Knowles gem loom, 20 harness, 4 by 4 boxes; one Knowles worsted loom, 32 harness; one Knowles fancy loom, with single-lift Jacquard; one Knowles fancy loom, with double-lift Jacquard; one Knowles fancy loom, with Jacquard tied up for leno; one 1,200-hook Halton Jacquard head motion, arranged to be transferred to different looms; one Knowles ingrain-carpet loom, 4 by 4 boxes; one Crompton gingham loom, 4 boxes; one Crompton fancy loom, 6 by 1, with double-cylinder 20-harness dobby; one Crompton fancy-cotton loom, with single-cylinder 20-harness dobby; one Crompton jean loom; one Crompton lappet loom, with 16-harness dobby; one Crompton towel loom; one Crompton ingrain-carpet loom, 4 by 4 boxes; one Crompton worsted loom, 27 harness; one Crompton worsted loom, 24 harness, 4 by 4 boxes; one Crompton & Knowles heavy loom, 20 harness, 4 by 4 boxes; also one Lewiston Machine Company loom, 4 harness, side cam, and one Lewiston Machine Company bag loom; also the following hand looms, viz—twelve hand looms, 2 by 3 boxes, with 20-harness dobby; eight hand looms, 4 by 4 boxes, with 24-harness dobby; six hand looms, 3 by 3 boxes, with 32 harness dobby; six hand looms, 4 by 4 boxes, with 30-harness dobby; two hand looms, with treadles; two hand looms, 4 by 4 boxes, with 200-hook Jacquard; two hand looms, 3 by 3 boxes, 200-hook Jacquard; two hand looms, 3 by 3 boxes, with 600-hook Jacquard; one Jacquard piano card-cutting machine, from John Royle & Sons, Paterson, N. J.

The silk machinery consists of one winder, one quiller, one warper, one beamer, and one doubling frame, made by the Atwood Machine Company, Stonington, Conn.

The motive power, etc., consists of one 30-horsepower motor, by the General Electric Company, Schenectady, N. Y.; two 20-horsepower motors, made by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; one 2½-horsepower motor, made by N. E. Motor Company, Lowell, Mass.; one 1-horsepower motor; one ⅓-horsepower motor; one complete system of fire protection, including sprinklers, air-pressure system, thermostats, and other appliances, by the General Fire Extinguisher Company, Providence, R. I.; one complete humidifying plant, by the American Drosophore Company, Boston, Mass.; one complete humidifying plant, by the United States Aerophor Air Moistening and Ventilating Company, Providence, R. I.

The dyeing department is fully equipped with complete chemical laboratory with individual benches, also small machines for dyeing and other processes; calico-printing machines, made by Mather & Platt, Oldham, England; one hydro-extractor, from W. H. Tolhurst & Sons, Troy, N. Y.; one jig dyeing machine; one jacketed iron steaming chamber, from A. Edmeston & Son, Salford, England; one drying

chamber; one ageing chamber; one set steam jacketed copper kettles, evaporating benches, etc. The school is well equipped with reels, balances, electrolytic and other scientific instruments for experimental purposes.

The knitting department has one Mayo automatic seamless knitting machine, one spring-needle cut-hose machine, and one latched-needle ribbed-hose machine.

The finishing department has one Rodney Hunt fulling mill; one string washer; hydro-extractor; tenter bars, driers, etc.; one wire napper; gig; one double shear, from Parks & Woolson Machine Company; press; steam brush.

The value of this equipment is $100,000, but fully $80,000 worth of it has been donated to the school. The building occupied by the school is rented, but is of modern slow-burning mill construction, equipped with freight and passenger elevators, steam heat, gas, and electricity, the latter for both power and light. Each room is protected against fire by sprinklers and thermostats, and self-closing fire doors are provided. The humidifiers, motors, shafting, belting, etc., are installed in the most modern manner throughout.

A sum of $140,000 is now on hand to be invested in a permanent home for the school, and a lot containing 3½ acres has been secured.

The day classes are especially intended for the instruction of those whose intention it is to enter the business of textile manufacturing in any branch. The courses are sufficiently complete to enable a person to start without any previous acquaintance with textiles, but at the same time those who have been engaged in such business and wish to improve their knowledge and opportunities can devote their entire time to study most profitably.

The complete collection of machinery enables every process to be practically illustrated.

The student has the option of selecting any one of five regular or several special courses. Each course is intended to cover three years.

There is one term of preliminary instruction which is common to all courses. At the end of this term each student is required to select which of the courses he is to follow in his subsequent studies, and the instruction to be given after the first term of the first year is specialized to suit each course. The five regular diploma courses are: Cotton manufacturing; wool manufacturing; designing, general course; chemistry and dyeing; weaving.

The courses of instruction in the day classes follow:

First year, first term (common to all courses): Design construction, cloth analysis, elements of mechanism, mechanical drawing, cloth construction, handlooms, general chemistry, and free-hand drawing.

COTTON MANUFACTURING.

First year, first term (common to all courses). See above.

First year, second term: Cotton fiber, microscopic examination of fiber, design construction, cloth analysis, elements of mechanism, mechanical drawing, cotton manipulation, cloth construction, handlooms, general chemistry, and free-hand drawing.

Second year: Cotton manipulation, machine drawing, textile chemistry and dyeing, designing, handlooms, applied mechanics, warp preparation, weaving, and cloth analysis.

Third year: Cotton manipulation, weaving, knitting machinery, designing, mill engineering, and thesis.

WOOL MANUFACTURING.

First year, first term (common to all courses). See above.

First year, second term: Wool fiber, microscopic examination of fibers, design construction, cloth analysis, elements of mechanism, mechanical drawing, woolen spinning, cloth construction, handlooms, general chemistry, and free-hand drawing.

Second year: Woolen and worsted spinning, machine drawing, weaving, textile chemistry and dyeing, cloth analysis, applied mechanics, warp preparation, designing, and handlooms.

Third year: Wool manipulation, weaving, knitting machinery, designing, mill engineering, and thesis.

DESIGNING.

First year, first term (common to all courses). See above.

First year, second term: Design construction, cloth analysis, design sketching, mechanical drawing, elements of mechanism, cloth construction, hand looms, free-hand drawing, and general chemistry. Options: Woolen and worsted spinning and cotton spinning.

Second year: Design construction, cloth analysis, design sketching and Jacquard work, decorative art, textile chemistry and dyeing, cloth construction, handlooms, weaving, and applied mechanics. Options: Woolen and worsted spinning and cotton spinning.

Third year: Designing, advanced work, mill engineering, weaving, and thesis. Options: Decorative art, woolen and worsted spinning, and cotton spinning.

CHEMISTRY AND DYEING.

First year, first term (common to all courses). See above.

First year, second term: General chemistry, stoichiometry, elements of mechanism, cloth analysis, qualitative analysis, mechanical drawing, designing, and handlooms.

Second year: Textile chemistry and dyeing, chemical philosophy, applied mechanics, advanced inorganic chemistry, and organic chemistry. Options: Designing and weaving.

Third year: Quantitative analysis, industrial chemistry, advanced textile chemistry and dyeing, dye testing, microscopy, and thesis. Options: Weaving and mill engineering.

WEAVING.

First year, first term (common to all courses). See above.

First year, second term: Design construction, cloth analysis, free-hand drawing, elements of mechanism, cloth construction, handlooms, mechanical drawing, and general chemistry. Options: Woolen and worsted spinning and cotton spinning.

Second year: Design construction, cloth analysis, decorative art, textile chemistry and dyeing, applied mechanics, cloth construction, handlooms, loom construction, and weaving. Options: Woolen and worsted spinning and cotton spinning.

Third year: Fabric structure, cloth analysis, analysis of weaving mechanism, weaving, mill engineering, cloth construction, handlooms, and thesis.

Candidates for admission to the day classes are required to pass an examination in arithmetic, English, geography, and algebra, or present evidence of proper qualification.

The fee for the day course is $100 per year for residents of Massachusetts; for non-residents it is $150 per year. Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time application may be made to the principal for a reduction.

All candidates for the diploma of the school must file with the principal not later than May 15 a report of original investigation or research, such thesis to have been previously approved by the head of the department in which it is made.

Advantages are offered to persons for special research work.

The diploma of the school is awarded upon the satisfactory completion of either of the five regular courses, covering not less than three years, except where entrance is to advance standing. In such cases at least one year's residence will be required. For the satisfactory completion of a three years' course in any special department the certificate of the school will be awarded; it is possible to complete such a course in less than three years, if the candidate be passed to advanced standing, but at least one year's attendance will be required.

The regular school sessions will be, in general, from 9 a. m. till 1 p. m., and from 2.15 to 5 p. m., except Saturdays, when the building will be closed in the afternoon.

Facilities are given for visits by day students to New England mills and works during the session.

The evening classes of the school are intended to give thorough instruction to those who are engaged during the day in mills and workshops, to enable those who wish it to perfect their knowledge of the branches in which they work, to acquire knowledge of other processes than those in which they are regularly engaged, and in the course of several winters to complete a thorough technical education without interfering with their daily duties.

Evening students have the option of entering for one or more of six different courses, and arrangements can be made for them to take such a section of each course as is suitable to the student's daily occupation in the mill.

The courses are: Cotton spinning, a three-year course; woolen spinning, a one-year course; worsted spinning, a two-year course; designing, a three-year course; chemistry and dyeing, a three-year course; weaving, a three-year course; mechanical engineering, a two-year course; also a course in warp preparation of one term.

For the satisfactory completion of either of these courses, the certificate of the school will be awarded; the diploma of the school will be awarded in exchange for certificates of satisfactory completion of those subjects which go to make up any one of the several regular diploma courses.

In general, it is possible to take up the study of two of the above evening courses concurrently.

The time devoted to practical work, both day and evening, is considerably longer than that devoted to lectures, and in order to make the instruction real and thorough, no student is allowed to pass to another machine or process until he becomes thoroughly acquainted with the one on which he is engaged.

The courses of instruction offered in the evening are identical with those of the day, with the exception that less time is devoted to the machine work, since in most cases this is of small moment. Ordinarily the handling of the machinery is a part familiar to most of the students through contact with it in the daytime, and in such cases the explanations and calculations are of the greater importance.

The requirements for admission to the evening classes are similar to those for the day. Graduates of other schools are received on presentation of proper credentials. For all others examinations are required. The candidates must be familiar with the English language and the principles of arithmetic. For the first part a short composition must be written on a given theme, and a certain amount must be written from dictation, while in the latter are included addition, decimals, fractions, percentage, ratio, and proportion.

The evening courses are free to graduates of the evening high and drawing schools, operatives of the mills and machine shops, and other residents of Lowell to such numbers as may be accommodated in the various classes. Applications are considered in the order in which received.

The fees in the evening classes are much lower than in the day classes. They are as follows:

Cotton, woolen, or worsted spinning, fee for all except residents of Lowell, $2.50 per term or $5 per year; designing, or chemistry and dyeing, fee for all except residents of Lowell, $5 per term or $10 per year; warp preparation, weaving, or mechanical engineering, fee for all except residents of Lowell, $2.50 per term.

Lectures are given during the school year upon the following subjects: Leather belting, general information on oils, electric driving in textile mills, fire protection in mills, cotton, cultivation of cotton, common uses of steam, water power, humidity in cotton mills, sizing compounds and their effect, method of cost finding in mills, patent law, and economy in steam plants.

During the school year of 1901-02 there were registered in the school students as follows:

Day students: First-year students, 38; second-year students, 17; third-year students, 10; art students, 7, and special students, 10; a total of 82. These students were divided among the courses as follows: Cotton manufacturing, 22; wool manufacturing, 17; designing, 9;

chemistry and dyeing, 12; weaving, 5; art course, 7, and special courses, 10; a total of 82.

Evening students: First-year students, 278; second-year students, 61; third-year students, 18; a total of 357. From these are to be deducted 8 students who were taking courses in two years, making a true total of 349. These students were divided among the courses as follows: Cotton spinning, 49; woolen and worsted spinning, 63; designing, 81; chemistry and dyeing, 67; weaving, 50, and mechanical engineering, 52; a total of 362. From these are to be deducted 13 students who were taking two courses, making a true total of 349. The day students, 82, and the evening students, 349, make a total of 431, but 7 students are members both of the day and evening classes and should be deducted, which leaves a true total of 424 students in the school at the date this information was secured.

The number of those who have received diplomas since the opening of the school is 28, and of those who have received certificates, 53. The present occupations of 26 former day students and 42 former evening students are known, and are as follows:

PRESENT OCCUPATION OF FORMER DAY AND EVENING STUDENTS, LOWELL TEXTILE SCHOOL.

Occupations.	Day students.	Evening students.
Artist	1	
Bookkeeper, textile mill		1
Carder, textile mill		1
Chemist (with dealer in dyestuffs)	1	
Designers, textile mill	1	3
Designers, assistant, textile mill	2	3
Designer and overseer of fancy weaving, textile mill		1
Draftsmen, machine shop		2
Draftsman, textile mill	1	
Employee, mining company		1
Employees, textile mill	3	
Employee, textile publication		1
Examiner of machinery	1	
Foreman, machine shop		1
Head of carding and spinning department, school of technology	1	
Inspector of textile fabrics, Government	1	
Inspector, textile mills		1
Instructors, textile schools	3	1
Instructors, assistant, textile schools	1	
Letter carrier		1
Loom fixers, textile mill	1	2
Machinist, machine shop		1
Manager and superintendent, textile mill	1	
Overseers, textile mill		7
Pin setter, textile mill		1
Second hands, textile mill		9
Section hands, textile mill		2
Storekeeper, textile mill		1
Superintendent, assistant, textile mill		1
Traveling salesman	1	
Treasurer, textile mill	1	
Weavers, textile mill	2	
Unemployed	1	1
Total	26	42

The annual cost of maintaining the school is about $26,000, and the funds for building, equipping, maintaining, etc., are raised by State and city appropriations, tuition and other fees, and contributions from a friend of the school.

Friends of this school maintain that its courses of instruction can not be improved except by raising the standard in the direction of the technical and scientific, giving more opportunity for the learning of higher mathematics and physics. The school is too young to draw many conclusions as to its benefits. It is said that the young men who have gone out from the school, although few in number, are assuming responsible positions and doing good work. Young men who expect to go into commission houses which sell the product of the mills are now taking courses in the school in order to become familiar with terms and mill possibilities. Many mill hands and machinists who are students in the evening classes have already felt the benefit of this instruction in higher wages and more rapid promotions. The students are preferred by employers to merely mill-trained hands, and applications from manufacturers to send them young men from the school are constantly being received. In all the manufacturing industries it is possible for the graduates of this school to work at their trades or occupations without undergoing a period of apprenticeship.

The labor unions have so far given the school moral aid only, but have not at any time actually opposed it. They were apathetic at first, but since the election of a labor-union man to the board of trustees many members of the union have visited the school and the knowledge of it and its methods which they have thus obtained has apparently greatly changed their feeling. Some individual labor-union men did oppose the school at first. They thought that it was intended only for the rich man, the sons of wealthy men, to give them a technical education such as would fit them to be managers of the great manufacturing properties when they should come into their hands. They appear to realize now that such opposition was not well founded, for while a technical education is provided for, and the intention is to even raise the standard to the highest, yet thorough and complete courses are provided for the workmen who can afford less time, and will always be maintained.

NEW BEDFORD TEXTILE SCHOOL, NEW BEDFORD, MASS.

The conditions and causes which led to the establishment of this school were substantially the same as those already explained in the case of the Lowell school. Advantage was taken of the act of 1895, providing for State aid for textile schools, and a corporation was organized, consisting of many of the leading manufacturers of New Bedford and other cities, secretaries of the labor unions of New Bedford, and several of its prominent citizens, the object being to insure the establishment of a school in which young men who are desirous of being trained for entering the cotton-manufacturing industry, and the mill workers who desire to advance and be promoted in their respective departments, may have every facility to learn the theory as well

as have the practice of cotton manufacturing in all its details, from the raw cotton to the finished fabric, and also have instruction in the scientific principles which underlie the construction of the machinery and its operation, and the artistic principles which are involved in the production of desirable and ornamental fabrics.

New Bedford is an especially suitable locality for an institution of this character. With but one exception, it is the largest cotton-manufacturing city in the country. High-grade yarns are produced to a greater extent than in any other city, while the mills are engaged in the manufacture of fine shirtings, muslins, lawns, sateens, lenos, checks, piqué, jacquard, and other fancy fabrics to an extent unknown elsewhere in this country. The mills are nearly all of recent construction, with the most improved equipments. The city is within short distances of Fall River and Taunton, in Massachusetts, and Providence, Pawtucket, and Woonsocket, in Rhode Island, and other large cotton-manufacturing centers.

The school was incorporated in 1895, the erection of the building was commenced in 1898, and it opened for instruction October 14, 1899. The total value of the building and equipment is about $75,000. Money appropriated by the State and city built and equipped the school building. Much of the machinery was given or loaned to the school by the manufacturers. The annual cost of maintaining the school is about $18,000, which is met by State and city appropriations, together with fees.

The power for the school machinery is derived from a complete steam plant on the premises, consisting of a 60-horsepower safety water-tube boiler and a 40-horsepower engine. The steam plant gives the students an exceptionally good opportunity of putting into practice their instruction on steam engineering, including as it does a feed water heater, oil separator, two feed pumps, and other accessories to a complete steam plant.

The heating of the building illustrates both the direct and indirect systems, and arrangements are made by which the building can be heated by live or exhaust steam, and condensation water returned automatically to the boiler or otherwise.

The building is equipped throughout with a system of Swedish mill telephones. The building is the first erected in the United States exclusively for the purposes of a textile technical school. It is of red brick, with trimmings of Indiana limestone. On the second and third floors, occupying the entire width and about half the length of the building, are rooms 65 by 70 feet, well lighted and ventilated, set apart to the textile power machinery. A part of the third floor is devoted to the designing and hand-loom weaving departments. In designing the school, attention was paid to arranging it in the most suitable manner for the purposes of imparting textile instruction, but the rear portion also serves to give an object lesson in cotton-mill engineering. The

structure is of the slow-burning mill construction type, while the general equipment of the school is also illustrative of the best methods of heating, ventilating, humidifying, and fire protecting mills.

The school has a wide variety of cotton-mill machinery, and this feature of the school is considered as being almost perfect for the purpose of a technical school that is to be devoted exclusively to the teaching of cotton manufacturing. Almost every maker of cotton machinery in the United States is represented in the school, together with several English builders, giving the student an opportunity of becoming acquainted with machines varied in construction, although utilized for performing the same work. No arrangements have yet been made for installing machinery for manipulating different fibers, such as wool, silk, etc.

The machinery is sufficiently complete to enable the raw cotton to be manipulated in the school at the several processes until it becomes a woven fabric; in fact, there is a sufficient surplus of machinery of the more important kinds to enable independent experiments to be conducted by the student, under the direction of the instructors.

The student thus has the opportunity of acquainting himself with the construction and operation of such machines as he may come in contact with later in assuming a position in a mill, together with the setting of the same and calculations connected therewith.

The equipment of the different departments is as follows:

The cotton carding and spinning department contains the following machines: Automatic feeder and single beater breaker lapper, made by the A. T. Atherton Machine Company; single beater finisher lapper, made by the Howard & Bullough American Machine Company, Pawtucket, R. I.; revolving flat card, made by the Mason Machine Works, Taunton, Mass.; revolving flat card, made by the Howard & Bullough American Machine Company; revolving flat card, made by the Saco & Pettee Machine Shops, Newton Upper Falls, Mass., and Biddeford, Me.; silver lap machine, made by John Hetherington & Sons, Manchester, England; ribbon lap machine, made by the Mason Machine Works; comber, made by John Hetherington & Sons, Manchester, England; railway head, made by the Mason Machine Works; improved railway head, made by the Saco & Pettee Machine Shops; first drawing frame with electric stop motion and metallic rolls, made by the Howard & Bullough American Machine Company; second drawing frame with mechanical stop motion and metallic rolls, made by the Saco & Pettee Machine Shops; slubber, made by the Woonsocket Machine and Press Company, Woonsocket, R. I.; first intermediate, made by the Providence Machine Company, Providence, R. I.; second intermediate, made by the Howard & Bullough American Machine Company; jack roving frame, made by Dobson & Barlow, Limited, Bolton, England; warp spinning frame, made by the Whitin Machine Works, Whitinsville, Mass.; filling spinning frame, made by the Howard & Bullough American Machine Company; spinning mule, made by the Mason Machine Works; twister, arranged for both wet and dry twisting, made by the Draper Company, Hopedale, Mass.; winding machine, made by the Universal Winding Company, Boston, Mass. These are in addition to several machines for card grinding, stripping, yarn testing, sizing, etc.

In the warp preparation and weaving department the equipment consists, in part, of: Spooler, from the Draper Company, Hopedale, Mass.; spooler, from the Easton & Burnham Machine Company, Pawtucket, R. I.; warper, made by T. C. Entwistle,

Lowell, Mass.; warper, made by the Draper Company; cone winder, from the Howard & Bullough American Machine Company, Pawtucket, R. I.; quiller, from the Atwood-Morrison Machine Company, Stonington, Conn.; reel, made by the Whitin Machine Works, Whitinsville, Mass. Also the following very complete assortment of looms: Crompton gingham loom, 4 by 1 box; fancy cotton Crompton loom, 6 by 1 box, with 20-harness dobby; Crompton leno loom, 4 by 1 box, 20-harness dobby; Knowles towel loom, 3 by 1 box, with 12-harness dobby; Knowles gem dress-goods loom, 4 by 4 boxes, 20-harness; Stafford leno loom, with 20-harness dobby; Stafford fancy cotton loom, with 25-harness dobby, and Stafford Jacquard loom with 400 hooks, made by the Crompton & Knowles Loom Works, Providence, R. I.; Mason gingham loom, 4 by 1 box; Mason print-cloth loom and fancy cotton loom, with 24-harness dobby, made by the Mason Machine Works; Northrop magazine loom, made by the Draper Company; 2 English plain looms, donated by Stoddard, Haserick, Richards & Co., Boston, Mass.; side-cam loom, made by the Lewiston Machine Company, Lewiston, Me.; heavy sateen loom, made by Whitin Machine Works; plain print loom, made by the Kilburn & Lincoln Company, Fall River, Mass.

A room is also devoted to hand loom weaving and the necessary power machines that are used for the preparation of warp and filling for these looms. The room is equipped with a number of hand looms adapted to the use of the students in experimental work, and in putting into practice the theory of designing that they learn in the school, and to enable them, at a small expense and with little trouble to themselves, to produce the fabrics that they have designed in the course of their studies.

The courses of instruction are divided into day classes and evening classes, and the courses are shown below:

Day classes: The principal course of instruction in the school is the general cotton manufacturing course (No. 1), which is intended to give a student a general knowledge of all the cotton manufacturing processes and sufficiently specific and complete information to qualify him to hold a position as superintendent of a cotton spinning and weaving mill, or other responsible position. The course covers two years.

It has been found that there is a demand for optional courses, and the following five alternate courses have been arranged: No. 2, yarn mill superintendent's course, one year; No. 3, weave mill superintendent's course, one year; No. 4, designer's course, two years; No. 5, mill engineer's course, two years; No. 6, dry goods commission house course, one year.

Students must be at least 14 years of age, and may be of either sex or any nationality. Those who have been students of other technical institutions, colleges, or universities, and graduates of high schools are admitted on certificates. Other applicants for admission to the school must either pass an entrance examination in arithmetic and English or present satisfactory evidence of necessary qualifications in elementary education.

The fee for tuition in the day classes is $50 per term of approximately four months, making $100 for the school year, for residents of

Massachusetts. The fee for others is $75 per term or $150 per year, in accordance with an act of the legislature.

The hours of instruction are from 8.30 a. m. to 12.30 p. m. each morning, except Saturdays, with afternoon sessions from 2 to 5 o'clock, except on Wednesdays and Saturdays.

Diplomas will be given on the satisfactory completion of a course of study.

The school is in session four evenings per week from 7.30 to 9.30 for the benefit of those students who are engaged in the mills and workshops during the day and who can devote only evenings to study. Practically, free education in any or all branches of cotton manufacturing is offered to those who can not defray the whole cost of their textile education. No difference is made between the courses of instruction of the evening and those of the day. The same machinery and same instructors are retained for the evening classes, and, in order to accommodate the larger number of students generally found in the evening technical schools, additional instructors have also been engaged for the benefit of the evening students alone.

A special feature of the evening instruction is in the minute subdivision of subjects, so that anyone employed in the mill will find in the plan of studies something that will assist him or her, and which will apply to the department in which he or she is daily engaged, and yet will not necessitate an entry for a long course of study in order to get such instruction as is desired. Satisfactory evidence of ability to read and write English and a knowledge of elementary arithmetic is required.

The fees for the evening classes are uniformly $2.50 per term of three months in each subject. Students taking two subjects and attending four evenings per week pay $5 per term. In a few subjects instruction is given free to residents of New Bedford.

While the main object of the evening classes is to give facilities for mill men to study special branches in which they are interested, arrangements are made by which a record of a student's work is kept, and by satisfactorily completing certain studies in each of two, three, or four winters he may complete a diploma course and have conferred upon him the diploma of the school.

This school so far may be considered experimental. Time may show need of change, though it is believed that it can be improved, if at all, only by the addition of new departments. Possibly, for instance, it would be an improvement to teach dyeing. It has been thought best to confine the course of instruction entirely to the manufacture of cotton in order not to waste strength, and for that purpose the school, it is believed, is thoroughly equipped, both in its courses of study and its machinery.

The school has not been in operation long enough to determine what benefits have resulted either to the industries of the locality or to the

general public or the business community. Its advantages are doubtless being felt as is shown by the warm interest the manufacturers are taking in it.

The staff of instructors numbers 13, principally mill overseers and superintendents, or those formerly holding such positions. The managing director, Prof. C. P. Brooks, M. S. A., is a recognized authority on textiles, a man of long experience in the superintendence and equipment of mills, and is instructor, examiner, and director of other textile schools, and is the author of several books on textile manufacturing.

During the first year of its operation, 1899–1900, there were about 300 students registered, 9 or 10 of whom were girls. There have been no graduates as yet.

The labor unions have, generally speaking, given the school moral aid, and one prominent labor union man is on the board of trustees. The loom fixers' union of New Bedford did oppose this school for a time for fear of its making too many workmen, and even now, though its active opposition has ceased, its members are talking of forming a trade school of their own. Several other labor unions were inclined to oppose the school at first on the ground that the workmen would be crowded out of it by the sons of rich men, manufacturers, etc., who would enter it in order to prepare themselves for positions of superintendents, agents, etc., and in order that they might be better fitted to manage intelligently property interests in manufacturing companies. The unions soon found this was a mistake on their part. The rich men's sons do enter the school but they enter the day classes, which so far are small, while the evening classes, which are quite large, are composed entirely of workmen.

While the school had had no graduates when this information was obtained yet several instances are known where those under its instruction had obtained promotion and higher wages as a result of the school instruction. Many employers have expressed their approval of the school and its work.

Following are the day and evening courses of study:

The courses of study for day classes are as follows: The regular cotton manufacturing course is intended for the training of men aspiring to the position of agent, superintendent, overseer, or other responsible position in a cotton mill or a cotton machinery works, or to give an opportunity to a man holding a responsible position to perfect his knowledge of the cotton mill business. It includes: First year—plain weaving, fancy weaving, designing, handloom work, mechanism and machine drawing, warp preparation, and steam engineering; second year—cotton picking, carding, combing, and spinning, mill engineering, advanced designing, and mechanism and machine drawing. Facilities are given in the second year for the students to carry on experimental work, and each student graduating is expected to write a thesis, or perform some special work in connection with some matter of general interest to a cotton manufacturer.

The yarn mill superintendent's course is intended to qualify a man to hold a position as superintendent of a cotton yarn mill, boss spinner or boss carder, or other responsible position in connection with a cotton yarn mill or cotton machinery

works. It includes cotton picking, carding, combing and spinning, machine drawing and mechanism, and steam engineering.

The weave mill superintendent's course is intended for men who desire to become superintendents of weaving mills, boss weavers or fixers or other positions requiring expert knowledge of weaving. It includes warp preparation, weaving, designing, handloom work, machine drawing, mechanism, and steam engineering.

The designer's course is intended to qualify a man to hold a position as a designer in any textile mill, whether cotton, woolen, worsted, or silk. This, in the first year, follows the lines of the general cotton manufacturing course. The second year of this course, however, is different, almost exclusive attention being given to designing and practice on hand and power looms.

The mill engineer's course is intended for those men who desire to follow the occupation of a textile mill architect or engineer. This follows the lines of the general cotton manufacturing course, excepting that especial attention will be given to instruction with regard to power plants, mill designing and engineering, and transmission of power, the nature of which will depend to some extent on the number of students entering for the course.

If a sufficient number of students enroll, a special course is arranged with regard to the manufacture and sale of dry goods. The manufacture of the goods is not treated of as technically as in the case of students who intend taking up the positions of mill superintendents, while other subjects, such as designs, materials, markets, costs, etc., are dealt with more fully than usual.

The courses of study for evening classes are as follows:

The course in carding covers picking and card-room machinery, including combing, to be completed in a two-year course, two evenings a week.

The course in mule spinning is a one-year course, two evenings per week, Monday and Thursday.

The course in ring spinning is a one-term course, two evenings per week, Tuesday and Friday.

The course in cotton sampling is a one-term course, one evening per week, Thursday.

The course in spooling, warping, and slashing is a one-term course, Tuesday and Friday evenings. This class is in session in February, March, and April.

The course in plain weaving covers plain weaving and loom fixing on all the different makes of American looms. It is a one-year course, two evenings per week, Tuesday and one other evening.

The fancy weaving course includes fancy weaving, including dobby and drop-box looms, both weaving and fixing. It is a one-year course, two evenings per week, Friday and one other evening.

The Jacquard weaving course covers one year, two evenings per week, Monday and Thursday.

In weaving instruction is also given in French.

In the designing department a course in cloth dissection is intended to be a primary designing study sufficient to meet the requirements of those connected with the weaving departments of the New Bedford mills without qualifying them to hold positions as designers. It is a one-year course, two evenings per week, Tuesday and Friday.

On hand-loom work is given a two-year course of one evening per week, Tuesday or Thursday.

The full course in designing covers designing of all kinds of cotton fabrics, including cloth dissection, cloth construction, and handloom work. It is a two-year course. This class is taken in two sections, as follows: Elementary—three evenings per week, Monday, Tuesday, and Friday, or Tuesday, Thursday, and Friday; advanced—three evenings per week, Monday, Friday, and one other evening.

A course in mill arithmetic is of one year, two evenings per week, Monday and Thursday.

A course in yarn-mill arithmetic covers one year, two evenings per week, Monday and Thursday.

A course in weave-mill arithmetic covers one year, two evenings per week, Tuesday and Friday.

GEORGIA SCHOOL OF TECHNOLOGY, ATLANTA, GA.

This institution is a department of the University of Georgia and was organized in 1888. The courses are mechanical engineering, electrical engineering, civil engineering, and textile engineering, and the degree of bachelor of science is conferred upon the graduates of each of these courses. As this school is devoted to the higher education in industrial lines preparing men for professions rather than for trades or occupations, it is really outside the scope of this investigation and would not be mentioned here but for the fact that its course in textile engineering is similar to courses in the textile schools of Massachusetts and Pennsylvania, which schools are described in this report at some length. Those schools, however, do not confer degrees. They differ, too, from this school in that they have numerous special day and evening courses of instruction designed to teach textile trades and occupations for the benefit of the workman, the mill operative, etc. As the report will show the existence of such schools in some of the States, and as their influence industrially appears to be considerable, it seems fitting that this mention of the Georgia school should be made although the particulars of the courses, management, etc., are not gone into. Except six free scholarships allowed to each county in the State, the charges for tuition are as follows: Residents of the State, $25 per annual session; nonresidents, $50. In addition there is a fee of $20 to cover contingent expenses.

AMERICAN CORRESPONDENCE SCHOOL OF TEXTILES, NEW BEDFORD, MASS.

This school has been in existence for several years, having been first established in Lowell, Mass. Its purposes and methods are similar to those fully described in connection with the courses in the correspondence schools. The courses cover substantially the same details as the textile schools just described, so far as is possible by correspondence. The outline of the subjects of instruction need not, therefore, be given here. In character of work the school is of course unlike the other textile schools in that the work is purely theoretical, being designed to supplement the work of those regularly engaged in textile mills. It is thus rather a technical than a trade school.

Students of the school who complete the course and have graduated are entitled thereafter to the benefits of the school by the payment of a small fee to cover cost of printing, mailing, and answering their inquiries. This applies only to students who have completed a full course in any subject.

The primary knowledge required for enrollment in the school is only that of reading and writing.

This school is divided into the following departments: Department of cotton manufacture, department of fabric designing, and department of woolen manufacture.

The courses in the department of cotton manufacture are intended for treasurers, agents, superintendents, overseers, second hands, third hands, mechanics, spinners, loom fixers, weavers, and other workers in cotton mills and machine shops, salesmen in commission houses, jobbers, converters, dry goods merchants, mill engineers and draftsmen, machinery salesmen, and others. The courses are the following: Complete cotton mill superintendent's course; cotton mill arithmetic course; cotton carding and spinning course; cotton spinning and warp preparation course; cotton warp preparation and plain weaving course; fancy cotton weaving course; cotton carding, spinning, and plain weaving course.

The courses in the department of textile designing are intended for designers and assistant designers, agents, superintendents, overseers, and second hands in weave rooms; section hands, loom fixers, weavers in cotton, woolen, worsted, or silk mills; dry goods merchants, salesmen in commission houses, jobbers, and all persons interested in textile designing. The following courses are laid out: Complete designing course; designer's calculations course; textile coloring course; theory of designing course; cotton designing course; woolen and worsted designing course; silk designing course.

The courses in the department of woolen manufacture are intended for treasurers, agents, or superintendents of woolen mills; also boss carders, boss spinners, and other overseers, section hands, and those who desire to qualify for such positions. The courses are also recommended to mill engineers and draftsmen, woolen machinery builders, erectors or salesmen, dry goods merchants or salesmen in commission houses. The following courses have been arranged: Complete woolen course; woolen mill arithmetic course; woolen carding and spinning course; woolen warp preparation and weaving course; fancy woolen weaving course.

There are 10 instructors engaged in teaching in these courses in addition to a director, in whose hands the management of the school lies.

There has been no hostility shown toward the school by labor organizations, but as far as known it has been approved by them.

Higher wages, steadier employment, and more rapid promotion have in many cases followed a course in this school; its graduates are preferred by employers to men trained only in the mills, and many employers have expressed their approval of the school. Generally speaking, the school has proven satisfactory and has fully attained the end for which established.

SCHOOLS FOR WATCHMAKERS, ENGRAVERS, ETC.

WALTHAM HOROLOGICAL SCHOOL, WALTHAM, MASS.

The need of better and more thoroughly equipped workmen in the trade of watchmaking, repairing, etc., led to the establishment of this school in 1870. Under modern conditions in the factories where watches are made the workmen are kept on special branches of the work, and no one has the opportunity to practice or learn the whole of the trade. The same thing is true in the job shops, where most watch repairers are trained, and as a result competent watchmakers who thoroughly understand the whole business and can make the complete watch, carrying it through all the different operations, are very few.

When a student has finished his course in this school he is able to make a complete watch, and is also a first-class repairer. While he may, and probably will, after graduation, devote himself to some one or possibly two branches of the trade, yet because of his thorough ground work he will be the more competent.

The hours of work in the school are on every week day from 8 a. m. to 12 m., and in addition from 1 to 5 p. m., except on Tuesdays, when the afternoon hours are from 1 to 6. Work is also required during such evenings as may be chosen by the manager.

The charge for tuition is $65 for the first three months, $50 for the second three months, $45 for the third three months, and $40 for each three months thereafter, payable quarterly in advance.

The course of instruction covers the following branches:

Plates: Punching rough blank, depthing and recessing for train, drilling, and tapping.

Barrel punching, turning, cutting teeth, and fitting arbor.

Wheels: Punching rough blank, cutting teeth and finishing for the train wheels, lever, duplex and chronometer escape wheels, and all the wheels used in watches.

Pinions: Cutting of rough blank, turning ready for cutting, cutting levers, pivoting, tempering, and polishing.

Jewels: Slabbing and sawing rough stones, drilling, turning, polishing, opening and finishing hole to fit pivot. All kinds of jewels are made, such as centers, plates, end stones, palates, balance, rollers, duplex rollers, chronometer detent, impulse, lifting, and jewels for all purposes for which stone is used.

Balances: Punching rough steel and brass, turning, fitting, brazing, recessing, crossing, drilling, tapping, and finishing.

Staffs: Pupils are required to make staffs for all classes and kinds of watches, from the rough stock to the perfect finish, from samples, or from measurement where the staff is lost.

Jeweling: Pupils are required to locate train, prepare the plates for setting jewels, and prepare jewels and settings for same, set them, fit to pivots, true settings to fit places, end shake, surface settings, drill, tap, counterbore, strip, and finish their work equal to the best produced in any watch factory.

Springing: Pupils are required to fit the balance to the staff, cut, true, and poise the balance, pick out the spring, fit it to collet, true it, vibrate it on the balance to time, pin it into the watch in beat and time by seconds.

Screws: Made from rough stock, turning, cutting thread, slotting, hardening, polishing, and bluing.

Stem-winding parts: All stem-winding parts, such as crown wheels, winding pinions, winding and intermediate wheels, rockers, levers, collets, springs of all kinds for all classes of watches.

Matching: Pupils are required to put the escapement together, setting the palate stones, adjusting for lock, drop, and let-off, also set jewel pins, adjust roller action, and see that the watch is in perfect beat.

Finishing: Pupils are required to see that all parts are thoroughly fitted, that there is the proper amount of end and side shake to the train, that the escapement is in perfect order, that let-off, lock, and drop are correct, and that the banking is properly set, that the roller action is perfect, and the watch in beat.

Adjusting: Pupils are required to see that the balance is properly trued and poised and the hairspring properly set and trued. The first test is for heat and cold, and when the balance is properly adjusted the test is made for isochronism; after that is obtained, errors are corrected for position.

Repairing: Pupils are required to replace old parts with new, also pivoting, bushing, and all other things pertaining to putting a watch which is out of order in good repair.

Tools: Pupils are taught to make and keep in repair pinion, wheel, and jeweling cutters, drills, turning tools, taps, dies, and all necessary tools.

Ophthalmology: Instruction in this branch is designed to give the pupil a thorough knowledge of the eye, how to fit glasses, and how to treat any ordinary disease of the organs of vision.

Engraving: All pupils who wish can receive instruction in all branches of engraving by a competent teacher without additional expense.

The time required to attain proficiency depends much on the pupil himself. With industry and diligence, and even only an ordinary amount of ability, it can generally be accomplished in one year. Diplomas are given to all who successfully complete the prescribed course.

Students are expected to purchase the smaller tools they use in ordinary bench work; the expense need not exceed $20. Lathes and lathe attachments and the more expensive tools are furnished by the school.

The management of the school conducts, independently, a manufactory of watch materials. This brings the school in touch with very many jewelers, etc., and affords a good opportunity of finding positions for graduates.

The school has 4 instructors, including a teacher of engraving and a teacher of optics, who is a regular physician and oculist. During the school year of 1899–1900 there was an average of 50 pupils in attendance. From 1893 to 1900 about 400 pupils were graduated. The number of graduates from the establishment of the school to 1893

can not be given, as the records for that period, during which the school was under a management different from the present, can not be found.

The annual cost of maintaining the school is $4,500; this amount is raised from the money received from pupils in fees.

It is stated that the school has improved the standard of work in the job shops of this locality, and to some extent in other parts of the country, as its graduates have gone to all sections. It has also decidedly tended to raise the standard of intelligence among the watchmakers and employees in the factories. Higher wages, steadier employment, and more rapid promotion have accrued to the graduates of the school, and they are greatly preferred by employers to the merely shop-trained men, owing to their greater capacity. They understand the watch better. They do not have to pass a period of apprenticeship upon beginning work, but start at once as full workmen. So far as the making of good workmen is concerned, this school has proved satisfactory and has fully attained the end for which established, although not always up to the desired result in making profits for its proprietor.

HOROLOGICAL SCHOOL, BRADLEY POLYTECHNIC INSTITUTE, PEORIA, ILL.

The Horological School of the Bradley Polytechnic Institute is a continuation of the Parsons Horological Institute. This school was founded by J. R. Parsons, at Laporte, Ind., in the year 1886, and was conducted there for eleven years. It was taken to Peoria by Mrs. Lydia Bradley in 1892, and received substantial aid and encouragement from her. In 1897 it became a part of the Bradley Polytechnic Institute, which was in that year founded and endowed by Mrs. Bradley, and a new building, large and thoroughly adapted to the work, was erected.

Horology hall has two stories and a basement, and is 100 feet long by 40 feet wide, containing five workrooms besides lecture room, main office, material room, drafting and experimental room, etc. It is heated by steam and lighted by gas and electricity. Being planned and constructed for the special purpose of the school, the rooms are large, light, and well ventilated. There are 103 outside or window-lit benches and over 50 inside benches, and room for more should necessity require it. The necessary power for the heavier work, such as large lathes, grindstones, emery wheels, blower for smelting and alloying room, is furnished by a 6-horsepower Eagle electric motor and a 4-horsepower gas engine. Each bench is equipped with gas and electric lights, and each department contains a large sink supplied with running water for washing work.

The cost of the building and equipment was about $20,000. The cost of maintenance is $9,000 per year. The funds for this purpose are supplied from the proceeds of an endowment and from fees from students.

The school is in session throughout the year and students can enter at any time.

There are 5 instructors. The final aim and plan of the school is to be practical. Theory is not neglected, but it is kept in its proper place. The instruction is as follows:

Students are taught to make some of the small tools, such as drills, countersinks, jewel gravers, jewel burnishers, screw taps; they learn the use of grinding materials, making forks, tempering, coloring, and polishing.

Lathe work of all kinds is taken up, such as turning staffs, setting jewels, turning down pinion leaves, square and cone pivots, fitting up cylinders, staking on and truing wheels, making collets, drilling for pivots and pivoting, slide-rest work, wheel cutting, milling, damaskeening, and all work pertaining to the lathe.

The work is first done on a scale of two or three to one, and then worked down to the very smallest scale. Each student is required to do the following work: Turning one center punch, two round burnishers, one hairspring colleter, four jewel pushers, four tapers for lathe (male and female), four each large and small screws (harden and blue), one cement brass, one drilling rest, two 4-millimeter steel wire square shoulders and finish, six cone pivots, two large staffs of steel and finish, centering one-half dozen wires, setting six large jewels, and finish settings.

Escapement work is taken up on a scale twice the size of an ordinary 18-size, or gentleman's watch, as by this method a novice can more readily comprehend the action of the several parts. The student is taught how to design, calculate, and make the several parts of the different escapements. Instruction is given in setting pallet stones, adjusting the banking, drop, let-off, locking, fork and roller action, fitting jewel pins to fork, figuring for size of wheels and pinions, uprighting, springing, etc.

After this the student is put to work on regular watch movements, being required to execute in a satisfactory manner the following work:

Making barrel head and uprighting; making case spring to fit watch; making square shoulder pivots, 1 millimeter to $\frac{6}{10}$ (4 sizes); making cone pivots to gauge, 10 to 6 (4 sizes); turning staffs to measurements; turning staffs for 3-arm balance and truing balance; turning staffs for expansion balance, truing and polishing; turning staffs to fit watches, poise and true; making hairspring collets; colleting hairsprings and overcoiling; vibrating hairspring, 16,000 to 18,000 vibrations; fitting hairsprings to watches and timing 18,000 vibrations; making stem-wind wheels, bevel wheel of brass, and crown wheel of steel, and polished; turning hollow center pinion to fit watch; making center square to fit same; finding size of cannon pinion and fitting; fitting dial wheel to same watch; fitting third wheel and pinion; fitting fourth wheel and pinion; fitting cylinders to watch; putting plug in cylinder; pivoting plain wires, square shoulder, 2 to $\frac{5}{10}$ pivots; pivoting plain wires, cone pivots, 2 to $\frac{5}{10}$; pivoting staffs for watch; setting jewels in plate, two set in plate, two with screws and two burnished, one hole and cap jewel in balance cock; making Swiss bridge and jeweling; fitting mainspring and hook in barrel; making three dozen pivot drills; putting three teeth in large wheel; setting pallet stones.

Students are admitted to the finishing department only after they have demonstrated their ability, either by completing the work of the elementary department or by passing an examination.

The study of the lever, duplex, cylinder, and chronometer escapement is accomplished by the aid of large drawings and models, afterwards by actual work on ordinary sized movements, thus giving theoretical and practical work.

Students are taught to make or replace any lost or broken parts in a workmanlike manner, to make cutters for cutting wheels, pinions, etc., when necessary. Advanced students are taught to cut and fit escape wheels for chronometer, duplex, or lever movements. Chronographs, repeating watches, and all complicated work are given to students when they are competent to handle it. Adjusting to temperature, position, and isochronism is a feature of the department which many old workmen of years of experience have repeatedly availed themselves of. In connection with the finishing department is the class in drafting, where the theoretical escapement work is taught; also the designing of new work, watch and chronometer movements, etc. The number in this class is limited to ten, having six hours' work each week.

In the engraving department the work of designing is first taken up, including the several styles of alphabets most in vogue—old English, script, block, etc. Next the student learns cyphers and monograms, scroll work, etc., after which the students are led step by step to the more difficult problems of transferring their designs onto metal by the use of the graver. Students who are naturally good in designing will get through this department in from six weeks to three months.

The instruction in the jewelry department includes all work required in a regular store service. The most important processes taught are the following: Hard soldering gold and silver articles, including the making of the solder; working gold up to different alloys, stone setting, making plain and band rings, hair mountings, raised monograms, badges, medals, bangles, charms, lockets, collar and cuff buttons, gold and silver plating, Roman coloring, etc.

The student is taught to repair all forms of clocks, including calendar and French clocks.

The institute gives a course in practice and theory of optics, conducted by a skilled practicing oculist. The length of the course is ten weeks, with three exercises per week. The course includes the study of reflection and refraction of light, lenses, prisms, physical structure of the eye; errors in refraction and the remedies; in brief, everything that an optician needs for actual business. The equipment includes all modern apparatus for the examination and testing of the eye.

The evening studies consist of a series of theoretical lectures on the various escapements, drafting escapements, movements, etc., depthing, springing, timing, adjusting to position, temperature, and isochronism.

Many of these lectures are illustrated with the stereopticon, by the aid of photographs of the minute parts made with a microscope.

Among the illustrated lectures are the following:

Time: Scientific methods of its measurements and history of instruments used in its determination.

Iron and steel: Illustrated by micrographs, showing the effect of overheating or "burning," case hardening, expansion in hardening, etc.

Adjusting to temperature: Showing the effect of heat and cold on the compensating balance and pendulum.

Refraction in the human eye: Showing how errors of refraction are corrected by the use of glasses.

The causes of watches stopping: How to examine and find causes; best way to repair. How to buy and sell; how to wait on customers.

How to take in and let out work: What to warrant and what not to warrant.

The total number of students graduated from the school is 436. Of this number, 305 were graduated in watch work, 72 in optics, 42 in watch work and optics, and 17 were graduated in optics and received certificates in watch work. Besides these graduates, there have been 38 students who have received certificates in watch work.

The students from the school are in constant demand and a thoroughly competent one never fails to get a good position. It is the policy of the management to assist all competent students in securing positions, whether they are graduates or not. Employers prefer them on account of their greater intelligence. No apprenticeship is required of the graduates. This school has been satisfactory, but it is hoped to make it more and more efficient.

WOODCOCK'S WATCHMAKING, OPTICAL, AND ENGRAVING SCHOOL, WINONA, MINN.

This school was opened in May, 1887. Its aim is to furnish training for those who desire to prepare themselves thoroughly for engaging in general watch repairing and the jewelry business. The full course of instruction embraces watchwork, clockwork, jewelry jobbing, and a course in optics. Upon payment of the full fee, students are entitled to the full course without limit of time. They are required to furnish their own tools and materials. The school is equipped with workbenches, but each student is required to have a bench at his room as well, that he may pursue his work after hours, if it is thought necessary.

The proprietor is the only instructor. His preparation for the work he has undertaken consists of a long apprenticeship, much practical experience, and special instruction under masters. The equipment of the school cost $2,000, and the annual running expenses are about $600. The cost of maintenance and the compensation of the proprietor are met by fees and a small amount taken for repair work.

The students find ready employment at good wages. They hold their positions well and rise rapidly in the trade. They serve no apprenticeships after leaving school with certificates.

HUTCHINSON'S SCHOOL FOR WATCHMAKERS, ENGRAVERS, AND OPTICIANS, LA PORTE, IND.

This school was opened in 1888. Its establishment was in response to a demand for a place where a practical and scientific knowledge of the trade could be gained outside of the slow and imperfect methods of shop training. It was claimed that there seemed to be a disposition on the part of watchmakers to impart as little instruction as possible, and the result was that the learner had either to spend too much time to get his trade or else he became discouraged and quit before he mastered it. Further, many things, especially about the scientific side of the trade, can never be learned in the shop, no matter how well disposed the instructor may be.

The curriculum covers watchmaking, engraving, and optics. There are 3 instructors. The principal served a regular apprenticeship, then worked in the factory of the Waltham Watch Company and took

a special course of training under the superintendent of the factory of that company. The teacher of engraving was trained in the Hutchinson school, while the instructor in optics is a graduate of the Chicago College of Physicians and Surgeons.

There are at present about 25 pupils; in all there have been 665 students and about 75 per cent of them have been given certificates of proficiency.

As many of the young men who attend these schools lack a sufficient knowledge of mathematics to enable them to properly prosecute the work, it is the opinion of the management that the course of study could be decidedly improved by adding the requisite mathematical training. And it would be well also to extend the curriculum so as to include mechanical drawing, details in fine turning (which would develop the sense of touch), electrical work used in plating and galvanizing, and a more thorough drill in horological science. This would require a three years' course and would not be too long, but the management can see no immediate possibility of these advances. Such extension can not be made unless money to assist in supporting the schools is provided from outside sources. Nevertheless, the watchmaking or watch-repairing business has in general been greatly improved by these schools. Those who have taken the course here have developed and cultivated habits of industry and thrift, and they reach positions that pay good wages much earlier than those who have merely had shop training. As a rule, however, it is claimed that there is a prejudice against school-trained men because their training means that the employer must pay better wages, and therefore the graduates of such schools are not usually preferred by employers or superintendents over shop-trained apprentices. But if a workman and not a helper is desired, the school-trained man is preferred, and it has been the experience of this institution that if an employer has had one of its students he always desires its men afterwards.

Schools of this class are as yet in their infancy and have of course not attained the end for which they were established, but the outlook warrants the belief that they will slowly attain it. The period of experiment is now passing, and hope is entertained that the progress of the next few years will be more rapid than that of all the past. In a general way this school has so far proved satisfactory.

ST. LOUIS WATCHMAKING SCHOOL, ST. LOUIS, MO.

At the time of the founding of this school, in 1888, the facilities for instruction in this kind of work in the United States were very meager.

The aim of the school is to offer practical training in watch and clock repairing, jewelry repairing, engraving, and optics. There are 3 instructors. The average number of pupils in each department is

25, and the total number of graduates between 300 and 400. The session lasts throughout the year and the hours of study are from 8.30 a. m. to 6 p. m. Pupils of both sexes are admitted. The terms are $15 per month. Each student is supposed to provide himself with necessary tools and materials.

Two courses are offered in optics, a regular course for those taking the course in watchmaking and a special course for those who take optics only. Students who take the special course may enter at any time; the tuition is $25.

The rental of the building is $360 per annum; the cost of tools and machinery, $2,000; and cost of maintaining, $5,000. These funds are raised through tuition and fees for repair work. Students capable of performing creditable repairs receive 50 per cent of the receipts derived from same.

It is the opinion of the management that the courses of study and training prescribed could be improved if more abundant means were at the command of the institution. As a result of the establishment of this school, the public now receives more skillful service and the workman who has taken the course finds his employment more steady and his salary increased. Its success has led to the improvement of ordinary shop training in the immediate vicinity and watchmakers who have previously worked at the trade for a period of years have found it to their interest to avail themselves of the superior training here afforded. Graduates readily obtain positions as journeymen without having to undergo a period of apprenticeship.

OMAHA WATCH REPAIRING, ENGRAVING, AND OPTICAL INSTITUTE, OMAHA, NEBR.

This school was established in 1895 and incorporated under the laws of Nebraska in 1898. The purpose of its establishment was to furnish opportunity to learn in a few months what under the old way required years of painstaking experiment and study to acquire. Each student is given practical work from the start, and leaves the school with a full knowledge of what is required in either holding a position or conducting a business. The average time required to complete the course is one year.

The average attendance is 35, and of this number 25 take the full course, and 10 take the optical course. Very few students remain long enough to obtain diplomas in the full course. The school sets a high standard, and examinations are very rigid. Only 10 diplomas have been granted to students in the full course. The optical department has graduated 65. The equipment of the school cost $2,000. The annual cost for maintenance, outside the compensation of instructors, is $1,200. There are 2 instructors, and they are paid from the net

profits of the business, whatever that may be. One of the instructors has served a long apprenticeship and has a diploma from the Ophthalmic College of Chicago, and the other is a graduate of the Watchmaking School of Winona, Minn. The school has no income except from students' fees and receipts from outside work done.

There is a division of sentiment among employers as to the merits of school training. Some prefer school men while others will not have them at all. The observation of the management is that when an employer once employs a school graduate he is thereafter a friend of the school. He finds the school-trained man to be a scientific, thinking workman, and a workman who thinks is more profitable than one who has not been trained to use his mind as well as his hands. He makes fewer mistakes than the shop-trained man, and he has better capacity for correcting his errors.

This school and others of its kind have proven satisfactory. They have not made money for themselves, but they have satisfied their patrons by doing what they promise.

JEWELERS' SCHOOL OF ENGRAVING, CHICAGO, ILL.

This school was established in 1889. The constantly increasing demand for engraved goods and the consequently greater demand for skilled engravers suggested that such an enterprise would pay, and at the same time open up a shorter road to success to young men and young women who might desire to follow the vocation of engraving.

The course of instruction embraces letter and monogram engraving on jewelry, watch cases, and silverware; etching, chasing, medal work, card-plate, and steel-die work are also included in the course if students desire them and have time to take them up. In addition to this regular course students have opportunity to observe the general features of jewelry manufacturing. The usual time necessary to complete the course is six months. The hours of work are from 8 to 12 a. m. and from 1.30 to 5.30 p. m., except on Saturdays, when there is no work in the afternoon.

The institution is under the management of the proprietor, and he is the sole regular instructor. Occasionally it is necessary for him to have assistance, and at such times an expert engraver is called in. The proprietor took courses in designing and engraving in schools at Dresden, Germany, and had special training under a celebrated engraver from Munich. Besides this he has had experience in German factories.

The average attendance of the school at present is 12. Since its establishment certificates of proficiency have been granted to about 450 students. The equipment of the school cost about $100, and the annual cost of maintenance is about $1,000. Expenses are met entirely by tuition fees.

The proprietor says that the course of instruction has been constantly improved and that there still is room for great improvement. He suggests that more attention should be given to designing, and that facilities should be provided for practical work in jewelry manufacture. This latter feature will require a considerable outlay of capital and it will consequently be slow in coming.

Practically all of the graduates of the school find employment in retail stores, and they have not, therefore, exerted any influence in general manufacturing lines.

It is not claimed that the graduates of the school receive higher wages than men trained in the shops, but it is claimed that one year of shop work after leaving the school enables the workman to command as good wages as would five years of shop training alone. During the first few years of the existence of the school there seemed to be a prejudice on the part of employers against its graduates, but this prejudice has gradually grown less pronounced, and now there is some demand for them. The graduates of the school do not have to serve an apprenticeship. The men serving apprenticeships see the rapidity with which schoolmen are advanced, and they are beginning to demand more attention and more definite instruction from their foremen. The foremen are therefore gradually improving the condition of apprentices.

This school has proved highly satisfactory. It has not fully attained the end for which it was designed. It takes time to develop systems of instruction in trades. Each year shows some advance, and the success of the past warrants the prediction that in time the ideals of the friends of this class of education will be realized.

BARBERS' SCHOOLS.

The success of manual-training schools and schools for the building trades, the mechanical trades, industrial design, and agriculture, suggested that there was an inviting field for the establishment of schools in which training for the barber's trade should be given. The advocates of the schools claimed that the three years' apprenticeship required in the shops gave little or nothing that could not be learned in a school in a two or three months' course. The apprentices had often complained that after a few months in the shop their services were almost, if not quite, as valuable as those of the journeyman, although they received only about one-third the pay of a regular journeyman.

The school courses established to offer this training vary somewhat in length and thoroughness of instruction, but all are of substantially the same character. Several of the schools add to the instruction in barbering and hairdressing training in manicuring and facial massage as a part of the required course.

As fairly representive of the kind and methods of instruction offered in barber schools of the better grade, the courses in the American Barber College, Omaha, Nebr., may be described. The course of instruction embraces:

> The selection, preparation, and care of tools; the technical work of shaving, hair cutting, shampooing, coloring, singeing, curling, etc. This technical instruction includes honing of razors, lathering and combing, stropping, shaving light beard, general shaving, hair cutting (lay down), hair cutting (pompadour), shampooing, dyeing and coloring, and a general review, consisting of any work that may come into the shop; instruction on the artistic basis of the toilet. This embraces a consideration of the different styles or fashions of wearing the hair and beard in their relations to the age, features, head formation, and general build of the person; instruction in facial dermatology, embracing such knowledge of the common diseases of the face and scalp as the barber must now understand in order to prevent contagion; instruction in facial massage, embracing the art of rubbing and kneading the face of the patron with the hands to stimulate thereby the circulation of the blood, the nervous system, and muscular action.

Practice for the students is obtained by giving their services to the public free of charge. Any clean white person can have any barber service he may desire performed by the students of the college without cost. A standing advertisement to this effect provides subjects for practice at all times.

The work of the school is designed to advance each student as rapidly as his proficiency will allow. Therefore, the instruction is not given under class regulations, but individually, the teacher imparting to each student such personal instruction, and advancing him according to his skill and capacity.

There is no definite or set period of instruction in the school. The time required depends entirely upon aptitude, industry, and perseverance. It is not the purpose of this school to see in how short a time it can rush students through the first principles of the trade, give them a diploma, and call them barbers. The aim is to qualify young men as barbers of the highest degree of proficiency. Students are graduated just as soon as competent, regardless of the time served in the school. The practice of the trade in the State is permitted only after examination by the barbers' State board of examiners of Nebraska. The shortness of time which a graduate may have attended the school is no ground for refusing a license, provided he is found to be a competent workman; but if he is not competent he can expect to be refused.

In most localities these schools have met with vigorous opposition from the labor unions. The most common ground of opposition has been that the schools tend to overcrowd the trade. It was claimed, too, that the schools did not afford sufficient time for the student to learn the trade thoroughly. It was claimed, on the other hand, by some schoolmen that the opposition really grew out of the fact that

the schools were taking from the shops the opportunity to hold apprentices for a long time at low wages.

In spite of this opposition the schools appear to prosper. Under the rules of the unions a school graduate can not obtain union employment until he has served an apprenticeship. In those States where barbers are required by law to pass an examination before a State board of examiners the restrictions of the unions are not felt so heavily. In other States the school-trained barber either opens a shop of his own or seeks employment in a nonunion shop. There has been in recent years some improvement in the conditions of apprenticeship, and it is by some attributed to the schools.

It has been generally admitted that in the schools as a class some improvement was desirable. More technical instruction and a greater emphasis on the artistic side of the trade have been urged by the school advocates.

With regard to the opposition of the unions and the improvement of the schools, the founder of the Omaha school has said:

It occurred to me that if I could convince the unions that I was attempting to do thorough work, and in fact was doing it, their support might be gained. So in 1899 I publicly advocated the idea of the craft controlling the schools. After earnest and patient endeavor in that direction I was at last rewarded with success, and the following agreement was entered into between the officers of the schools and the various barbers' unions of Omaha:

AGREEMENT.

This agreement made this 12th day of November, A. D. 1900, between The American Barber College (a corporation) of the City of Omaha, county of Douglas and State of Nebraska, party of the first part, and the barbers of Douglas County, Nebraska, in mass assembled, of the city of Omaha and South Omaha, county of Douglas and State of Nebraska, party of the second part, witnesseth: That the party of the first part, for and in consideration of the covenants hereinafter contained on the part of the party of the second part, does hereby covenant and agree to and with the said party of the second part:

That there shall be created a board of three practical barbers, to be constituted as follows: The president of the J. B. I. U. of A. Local No. 212, of the city of Omaha, the J. B. I. U. of A. Local No. 64, of South Omaha, Nebraska, and the B. P. A. Local No. 1, of Omaha, Nebraska (or such other executive officer of the said unions as such unions shall elect). The said board shall choose at each sitting two members of the barber craft to aid them in the discharge of their duties, and the said board shall sign all diplomas together with faculty of the said The American Barber College, party of the first part, whom shall be by such board declared competent to practice the barber's trade.

It shall be the duty of this board to sit as a board of examiners at least once in each month for the purpose of determining the competency of all students of the said The American Barber College, party of the first part, as shall be recommended by the craft's advisory board as hereinafter created.

There shall be created a board of three practical barbers to be known as the craft's advisory board, said board to be composed of such persons as have been selected

by the barbers of Douglas County in mass assembled, party of the second part, to wit, Louis V. Guye, James E. Ryan, and John Dingman. The said board shall be associate members of the faculty of the said The American Barber College, party of the first part, and it shall be their duties to inspect the sanitary conditions of the said The American Barber College, party of the first part, at least once in each month; to prescribe such sanitary rules and regulations as are reasonable, and which shall not conflict with the laws of the State or the barbers' examining board or their secretaries; each member of such board shall give lectures to the students of the said The American Barber College, party of the first part, upon such subjects as the president of such college shall deem advantageous and proper.

The said The American Barber College, party of the first part, further agrees that it will adopt such additional branches of learning as are required by the barbers' examining board in their examinations for a State license.

The said The American Barber College, party of the first part, further agree that it will submit its advertisements to a joint board of five (5) practical barbers and one (1) practicing physician, such board to be constituted as follows: The craft's advisory board, as created and known under this agreement, and the barber's examining board, as created under the laws of the State of Nebraska, for their approval or rejection, and the said The American Barber College, party of the first part, shall not publish, post, or display any advertisements for students without the approval (or sanction) of a majority of the members of such joint boards.

That the said The American Barber College, party of the first part, further agrees that it will appoint one member of the craft which shall be a practical barber, and who possesses the ability of an instructor, as a member of its faculty, from such persons as shall be recommended by the advisory board as herein created, such person so appointed to be subject to removal by such board for (a) incompetency or (b) negligence of duty to the craft or the college. This said member of the faculty of the said The American Barber College to be the head instructor in the technical art of barbering in such college, and at no time to perform any of the duties of a barber to the public (or patrons of such college) other than are necessary in order to make clinic demonstrations when giving instructions to the students of such college. Such member shall also be a councilor with the craft and the executive officers of such college for the furtherance and upbuilding of the said The American Barber College.

That the said The American Barber College, party of the first part, further agrees that it will at no time employ any practical barber in such college other than the faculty of such college.

That the said The American Barber College, party of the first part, further agrees that it will, as soon as practicable, close at the hour of twelve (12) m. on Saturdays and remain so closed until seven (7) a. m. on the Monday following, the said boards as herein created and designated, together with the executive officers of the said The American Barber College, to be the judges as to when it is practicable to do so.

And the said the barbers of Douglas County in mass assembled, party of the second part, in consideration of said covenants on the part of the party of the first part, does covenant and agree with the said party of the first part that they, the parties of the second part, will allow the president or executive officers of the said The American Barber College (a corporation), party of the first part, to have the power to reject the person or persons as recommended by the board of advisement, as herein created as members of the faculty (or technical instructor) for (a) incompetency, or (b) neglect of duty, or (c) failure to comply with the rules and regulations of the said The American Barber College; but all such rejections shall be reported to the J. B. I. U. of A. Local No. 212, the J. B. I. U. of A. Local No. 64, and B. P. A. Local No. 1, together with the reasons for such rejection, whereupon the said unions shall proceed to investigate the said charges (or reasons) for such

rejections, and if found just and proper, then the said advisory board shall then proceed to recommend to the said The American Barber College, party of the first part, a person or persons to fill such vacancy.

In witness whereof we have hereunto set our hands and seal the day and date first above written.

J. B. RANDOLPH,
President American Barber College.
W. F. WILLIAMS,
Secretary American Barber College.
FRANK FITZSIMMONS,
Chairman Mass Meeting of Barbers of Douglas County.
NEAL F. RYAN,
Secretary of Barbers' Mass Meeting of Douglas County.

[Seal of the American Barber College (a corporation).]

Witnessed by—
JAMES E. RYAN.
LOUIS V. GUYE.
J. P. SULLIVAN.
JOHN DINGMAN.
H. ELSASSER.
STANLEY HEADLY.
J. L. TORPP.

It is believed that the experiment now being made (for it is only an experiment) by this school will set a higher standard for similar schools everywhere, and enable them to take the high stand the trade deserves they should. This is the end sought, and it is believed that it will be attained. It was a question of craft control and better schools, or a continuation of that warfare which only aggravated the case. It is true that there are now many individual barbers who are not in full sympathy with the unions in indorsing the school, but the number is growing less, and it is believed that in time all the barbers will become its friends.

The statistical details with regard to schools of this class from which reports were secured follow:

STATISTICS OF BARBERS' SCHOOLS.

Name and location.	Date of establishment.	Cost of equipment.	Annual cost of maintenance.	Length of full course (months).	Number of instructors.	Average number of students.	Number of graduates.
Iowa Barber College, Des Moines, Iowa	1899	$800	$1,200	2	2	10	80
Moler Colleges of Barbering, etc., Chicago, Minneapolis, New York, St. Louis, and San Francisco	1893	15,000	25,000	(a)	15	300	2,000
American Barber College, Omaha, Nebr	(a)	1,000	2,500	(a)	6	25	50
Blackman's Barber College, Cincinnati, Ohio.	1898	250	250	2	1	8	100

a Not reported.

MISCELLANEOUS TRADE SCHOOLS.

NORTH BENNET STREET INDUSTRIAL SCHOOL, BOSTON, MASS.

This school was established for the purpose of giving a general education and instruction in manual training to the children of the poor. The school as a whole does not come within the purview of this investigation. A special course, however, started in 1897, which teaches clay modeling as applicable to wood and stone carving, does teach a recognized trade and consequently has a right to consideration here.

This course was established for the reason that representations as to its need were made by architects. There was no school in the country teaching this trade and only unskilled workmen, or foreigners imported in evasion of the alien contract-labor law, could be obtained by the employers. The instructor, trained in stoneworks in England as a modeler and wood and stone carver, follows such course of instruction as seems best to him.

During the last school year (1899–1900) 17 boys and 8 men, a total of 25 pupils, took the course. It is open to workmen in the shops as well as boys over 14 years of age. There is no fixed period of study and no formal graduation, and a pupil is not considered as having finished his course until the instructor says that he is fitted for employment at the trade. Four so far have taken the full course and they are all employed in one shop, the proprietor of which prefers them to such shop-trained men as are available.

The annual expense of maintaining this course is only $160, and the funds for this and all other purposes of the school come principally from donations of Mrs. Quincy A. Shaw, of Boston. A few others give small amounts.

This course can be improved, if at all, only by giving more theoretical instruction than is now done. The outlook for this is not favorable, as the course is entirely a practical one and is not designed to make artists or originators, but artisans only. Benefits of any kind accruing in this locality from the establishment of this instruction are exceedingly small as yet, as the course has been in existence so short a time. Those who have taken the full course in this trade have not been obliged to serve an apprenticeship when commencing work. The course has proven satisfactory so far as it has gone, but will not fully attain the end for which established until it has graduated enough workmen at this trade to supply the demand.

WASHINGTON LINOTYPE SCHOOL, WASHINGTON, D. C.

This school was established in 1899 to provide linotype instruction for union printers who have had no shop training in this particular kind of machine work. When machines are introduced into a printing

office it is often the case that the number of printers is reduced. Those who are selected by the management for retention are trained to operate the machines, while those who are dropped have no opportunity for such training and are often unable to secure employment on account of this deficiency. This school was opened specially for this class of printers, and it has enabled many of them to obtain situations.

Only union printers, or applicants to a union, working under permit, are admitted. There are three courses of instruction, as follows:

The mechanical course: This course is designed to give the student a sufficient knowledge of the mechanism of the machine to keep it in running order under ordinary conditions, to make ordinary adjustments and minor repairs and substitution of parts. The school is supplied with a second-hand or "dummy" machine which is torn down and built up by the students under the instruction of a skilled man, who explains the use of each part and teaches the student to make every adjustment of the linotype. In addition to this the student is required to clean a running machine once a week. The time prescribed for this course is six weeks, but those who do not feel competent within this limit can have their time extended without extra charge. The price of the course is $50.

The operating course: This course is for those who may have learned the mechanism of the machine in a linotype factory or elsewhere, and need only skill to operate. The course extends over six weeks. The fee is $60.

The combined course: This course is what its designation implies—a combination of the two courses just described, and is designed for those who have absolutely no sort of machine instruction. The price of the combined course is $85.

The school is the property of a stock company composed of twelve union printers, and is managed by the president and the secretary of the company. There are two instructors, one in the mechanical course and one in the operating course. Both of them are qualified from long experience to render good service. The school issues no diplomas or certificates, but allows its students to remain until they feel satisfied to undertake to fill positions in an office. The average number of students attending at one time is 10. The most expensive part of the equipment consists of linotype machines, but they are leased. The annual cost of maintenance is about $4,000, and this expense is met by tuition fees.

The school has not been formally recognized by unions, but individual members recommend it to printers. Since none but union printers are admitted, there has been no cause for union opposition. Former students do not receive more pay than any other printers. The fact that they are union men gives them union rates and no more. There is no preference shown by employers for school-trained men. The

school does not claim that its men are more efficient than shop-trained men—only that they are just as good, and employers seem to take the same view. They want capable men, and do not care where they were trained. Shop training is good, but shops which do not use machines can not, as a matter of course, give such instruction to their apprentices. An apprenticeship covers four years, and in those shops where there are machines sufficient time is given them on machine work to enable them to operate them.

The school has passed beyond the experimental stage and has fully met the expectations of its founders. The success of its students encourages it to believe that its work is recognized as valuable to all concerned

ILLINOIS COLLEGE OF PHOTOGRAPHY, EFFINGHAM, ILL.

This institution is devoted exclusively to teaching high-class photography. It is difficult to induce first-class photographers to take apprentices, as good photographers have all the work to which they can attend, and have no time to devote to students. As a rule, therefore, pupils are compelled to accept places in second or third rate establishments, where they are expected to do the studio drudgery and perform all odd jobs, a course possible for male students, but altogether impracticable for females. The founders of this institution, therefore, determined to establish a school where both sexes could be thoroughly taught the technique of high-grade photography.

The school was opened in 1893, with one student. Its annual enrollment is at present more than 250.

There are 7 instructors. The complete course of instruction embraces every branch of high-grade photography, including artistic retouching, modeling, and etching; artistic posing, lighting, and composition; printing, toning, and finishing; carbon and platinotype, and a course in negative making.

Pupils receive both individual and class instruction.

Instructors endeavor to inculcate the principles and manipulations of the standard makes of dry plates under every condition, and in their varied effects and defects; under and over exposure, under and over development, density, intensity, softness, brilliancy, transparency, contrast, flat lightings, light effects, dark effects, groups, softening of films, weakness of images, slowness of development, fog, spots, lines and granularity, etc. Everything is done to equip each student for scientific work.

Besides the full course, there are two special courses—a course of from two to six weeks for both amateurs and persons who have had some experience. The tuition for these shorter courses is $50 for four weeks and $5 per week for additional time. But tuition for the full course may be taken in the form of a life scholarship for $75.

Besides the regular fee for tuition, students are subject to a laboratory fee of $10 and a fee of from $3 to $5 per month for material, etc., making the probable total cost of the full course, including tuition, material, room, and board, from $125 to $185.

The hours are from 8 a. m. to 12 m. and 1.30 to 4 p. m. each week day except Saturday, and it requires from three to five months to complete the full course.

There are two school buildings. The main college building is a substantial edifice of Virginia brownstone, pressed brick, and New York red slate. It contains 44 rooms and is heated by steam and lighted by gas and electricity, and is fitted with well-equipped sanitary appointments. The other building contains the laboratories, printing departments, assembly rooms, studios, finishing rooms, etc.

The management believes the course of study and training here could be improved only by lengthening. As a result of the establishment of the school the previous work of students, who are from all parts of the world, has been improved to the extent that they command higher wages. Graduates of this school are preferred over merely shop-trained apprentices, and it is felt that the institution has been successful.

SOUTHWESTERN RAILWAY TELEGRAPH SCHOOL, ST. LOUIS, MO.

This institution was established about sixteen years ago by the officials of the telegraphic departments of the Missouri Pacific and Wabash Railway companies.

The necessity leading to its establishment was that the usual practice of training operators in offices was not satisfactory, there being a lack of thoroughness and uniformity of method and an entire absence of technical skill in electrical matters. The aim of the officials was to found, supervise, and operate a school that would eliminate these difficulties.

The school is under the management of the superintendents of telegraph of the Missouri Pacific and Wabash Railway companies. There are usually 4 instructors, each of whom is a practical man, having been selected from the telegraphic and auditing departments of the companies operating the institution. About 970 graduates have gone out from the school, and most of them have found employment either with the above or other companies. The school is maintained by tuition fees.

The telegraphic labor unions have opposed it upon the ground that it has produced more operators than is necessary to supply the demand. Notwithstanding this, the school has upon the whole proven very satisfactory, and has fully attained the end for which it was established.

WEBB'S ACADEMY AND HOME FOR SHIPBUILDERS, NEW YORK, N. Y.

Webb's Academy and Home for Shipbuilders owes its origin to the late William H. Webb, naval architect and shipbuilder. Mr. Webb was the son of a prosperous shipbuilder, and at an early age manifested a liking for ships and ship construction. From the time of his apprenticeship until the day of his retirement from active business life Mr. Webb was a diligent student and an energetic worker in the cause of the science and art of shipbuilding. Concurrently with his professional work, Mr. Webb gave much attention to the educational problem. Recollecting the difficulties he had encountered in acquiring a knowledge of the technique and science of his profession, he determined to found an institution where naval architecture and marine engineering would be taught to deserving students without any cost to them. On April 2, 1889, Mr. Webb's ideas were given practical expression in the incorporation of Webb's Academy and Home for Shipbuilders.

The site selected is located at Fordham Heights, New York City, on the easterly banks of the Harlem River, just north of the University of New York, and contains about 14 acres, upon which are numerous large shade trees and extensive lawns. The building was completed in February, 1894, and the entire property was formally presented to its trustees on May 5, 1894. The building is of yellow pressed brick, with brownstone trimmings. The greater part of the structure is five stories in height, with two additional stories in that portion occupied by the school.

The ground floor of the building contains a spacious hall and broad stairway, reception room, parlor, a suite of rooms each for the matron and housekeeper, an office for the resident manager, and an extensive dining room. The floor above is devoted wholly to sleeping rooms, with the exception of a reading room and library, which has about 1,500 volumes, including both scientific works and fiction. On the third floor are more sleeping rooms and a well-filled museum. It is here the visitor finds much of interest in the models of different craft built by Mr. Webb, varying from the little harbor tug to the powerful ram *Dunderberg*. Here the student of naval architecture notes the changes that have gradually taken place in the general construction of vessels during the last sixty years. Attention is also drawn to the large number of paintings and engravings illustrative of vessels, varying in type from the ancient galley to the modern war ship. Sleeping rooms occupy the whole of the fourth floor. Then come two of the drawing rooms, the instructor's office, the mold loft, and the workshop. The sixth floor has another large drawing room and a lecture room, while on the floors above the latter are the physical

laboratory and gymnasium. There is a dark room for the development of photographs, and upon the roof a special arrangement for taking blue prints of the largest size.

As its name would indicate, the institution provides a home for aged, indigent, or infirm men who have been engaged in building hulls of vessels or marine engines, together with the wives or widows of such persons; and an academy to "furnish to any young man, a native or citizen of the United States, who may upon examination prove himself competent, of good character and worthy, free and gratuitous education in the art, science, and profession of shipbuilding and marine-engine building, both theoretical and practical, together with board, lodging, and necessary implements and materials while obtaining such education."

The system of instruction employed in the school is somewhat unique. It is intended more especially to give the pupils such a thorough training in the art and science of ship and marine-engine construction that when they graduate they will be fitted to enter the drafting room, where their special knowledge will enable them to perform the most difficult parts of the work. In other words, the school does not pretend to turn out naval architects nor marine engineers. Development along these lines is left to subsequent acquirement through practical experience in the industry. It does, however, qualify the graduates to do the highest order of practical work in the drafting rooms, where they are usually employed.

The first examination of applicants for admission was held in January, 1894, at which time eight students were admitted, and in May following two more. Since then examinations for entrance have been held but once a year.

Candidates for admission must be between 15 and 20 years of age, and their application must be made to the president of the academy not later than the 1st day of September of the year in which the applicant expects to enter. Owing to the limited accommodations for students and the ever-increasing number of those applying, it has been found necessary to subject all candidates to a very rigid competitive examination in the subjects required for admission, which at present embrace the common English branches, together with algebra up to and including quadratic equations, geometry, both plane and solid, and plane and analytical trigonometry.

Of the students thus far received into the academy, a large majority have come either from the vicinity of New York or from those States bordering upon the Great Lakes. During the history of the school the following States have been represented by students: Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Georgia, Ohio, Indiana, Iowa, Michigan, and Minnesota.

The school year begins in the second week in September and extends

until the second week in June, with a short vacation at the Christmas holidays and at Easter.

During the school year all students must live in the academy, but the privilege of spending Sundays at home is generally granted to those whose homes are in the city or nearby towns, providing their work has been satisfactory.

In sickness they receive the care of one or more of eight physicians who render gratuitous service to the institution. In case of severe illness they may be removed to the hospital with which the academy is provided. But one death has occurred among the students, and that was due to quick consumption.

The work for the day is divided, according to the old-fashioned way, into two sessions—from 9 to 12 o'clock in the morning and from 1 to 4 o'clock in the afternoon. No sessions are held on Saturdays, but most of the students during the morning avail themselves of the opportunity of doing original or advanced work.

The course of studies extends over a period of three years, and is as follows:

In mathematics a course in advanced algebra is given, in which are especially considered variables and limits series, continued fractions, the binominal theorem, determinants, theory of equations, and the general solution of equations; a supplemental course in trigonometry covering the solution of trigonometrical equations; descriptive geometry with reference to the intersection of planes, curved and warped surfaces; analytic geometry covering (1) plane geometry as applied to loci and their equations, the straight line, the circle, different systems of coordinates, the parabola, the ellipse, the hyperbola, loci of the second order and higher plane curves, (2) solid geometry, involving the point, the plane, the straight line, and surfaces of revolution; the calculus as a means for finding the quadrature of surfaces, the cubature of volumes, the center of gravity, and the moment of inertia of different areas and volumes; in hydrostatics pressures on surfaces are found, centers of pressure, resultant horizontal and vertical pressures, equilibrium of a floating body, stability and metacenter, with special problems upon the same; mechanics, with special reference to rectilinear and periodic motion, curvilinear and rotary motion and projectiles; strength of materials, with an exhaustive treatment of cantilever and simple beams, compression of columns, torsion of shafts, apparent stresses and true stresses, and stresses in guns.

The course in marine engineering begins with a general investigation of modern marine engines, boilers, and auxiliary machinery; of the conditions under which they work in practice; and of the subjects of fuels, combustion, and evaporative efficiency. The indicator and its diagrams are studied, and, when opportunity is afforded, students make short passages on coastwise steamers for indicator practice and the observation of marine machinery under weigh. A considerable amount of time is given during the first year to mechanical drawing and tracing, the models for the latter being selected from the large collection of prints of marine engines which forms a part of the equipment of this department. The instruction in drawing is continued through the reproduction in finished drawings of sketches, with dimensions to the preparations of original designs of engine details. The valve gears used in marine practice are investigated and laid down. The subject of heat is studied, and that of the theory of the steam engine follows. The design, construction, and operation of marine steam boilers and the design and drawing of various types of the screw propeller are subjects on which stress is laid. The design of, and working drawings for, propelling

machinery for vessels is begun in the second year and is pursued until the end of the course, including all important parts from the cylinder to the propeller. Students who make a specialty of marine engineering pass the vacation period in the machine shops of shipyards or in the engine rooms of seagoing vessels.

In naval architecture the course embraces both the theoretical and practical. The student is first required to make the calculations of areas and volumes to different water lines for a given vessel, then to get out a displacement sheet and the tons per inch curve, the area of midship section, together with its coefficients, is found; the center of buoyancy, its position vertically for change of draft, and the longitudinal position of center of buoyancy are discussed and their loci found; trim, centers of effort and pressures, tonnage, freeboard, and surplus buoyancy are treated; a vessel's stability is considered, while calculations for and construction of curves of the same are made; curves of buoyancy, loads, sheering force, and bending movements of different classes of vessels floating in still water are gotten out; the formula $\frac{p}{y}=\frac{M}{I}$ as applied to the ship as a girder is investigated; the stability of different types of vessels under peculiar conditions; resistance at surface and deeply submerged are inquired into; stress on upper edge of sheer strake when vessel is inclined, and stresses on the structure of the hull for different conditions of lading are investigated, followed by calculations especially required for launching diagrams.

The work in practical naval architecture is laid out along lines parallel to the theoretical, and consists of work in the drawing room, mold loft, and shipyards. In the drawing room the students familiarize themselves with the proper use of drawing instruments, planimeter, etc., make tracings of detail drawings, derive and plot the several curves mentioned under theoretical naval architecture; compare the scantlings of a given steel steamer with the different insurance societies' rules, prepare a sheer draft, and make a half model of the same. The different methods of preparation and assembly of the various parts of a ship in proper order, preparing slip, laying blocks, different ways of bending and setting frames, floors, and beams, the laying and fitting of various kinds of keels, stern and rudder frames, construction of bulkheads, pillaring, hatches, bridges, etc., are in turn considered and drawings of the same are made.

In the mold loft a wooden ship is first laid down and faired up, and molds of the several parts actually made. This work is followed by the laying down of a cargo steamer, the working drawings of which have already been made in the drawing room, and the preparation of the scrive board and molds. A half model of this steamer is then made and lined off completely. Owing to the ample floor space of the mold loft, much of the work can be laid out in full size.

In order that students may acquire a more extended knowledge of practical naval architecture and marine engineering than it is possible for them to secure at the academy, all undergraduates must pass about eight weeks of the summer vacation at work in various shipyards throughout the country. While thus engaged they receive wages commensurate with the services rendered, and in many instances are offered permanent employment, but they always return to complete their course at the academy. Those students of the graduating class who wish to enter the employment of the Government are allowed to take the civil-service examinations, which are held usually a month or two prior to the final examinations at the academy. Every student who has taken these examinations has passed them successfully and received his appointment shortly after, and in some cases even before

graduation. With the exception of one, whose eyes failed him, every graduate from this institution is either in the employ of the Government or engaged at some private shipyard. One is located on the Pacific, and all the others on the Atlantic coast.

The school is under the general management of a board of trustees. The faculty consists of 3 instructors, all of whom, in addition to being college graduates, have had many years of practical experience in their respective branches. The number of pupils in the different classes during the past year was as follows: Junior class, 17; middle class, 10; senior class, 11. The number of graduates is 38. The cost of the building and its furnishings, together with the grounds, reached nearly $500,000. More than two-thirds of this amount might be properly apportioned to the purposes of the school. The maintenance of the institution has been amply provided for by the founder by the deeding to the corporation of very valuable property, both in New York City and elsewhere. The cost of maintaining the school alone is about $20,000 per annum.

It is the opinion of the officials that the courses of training and study are the best that could be arranged for the purpose. Improvements are made when justified by experience or necessity. It is, perhaps, too early to speculate upon the benefits that may have accrued to the shipbuilding industry as a result of the establishment of this school. It is thought, however, that the graduates have already demonstrated the usefulness of the school by the services they have rendered to the industry at large.

The best evidence of this is the unstinted praise that is bestowed upon the school by the leading shipbuilding establishments of the country. There can be no question or doubt regarding the benefits derived by the young men who have been under instruction in the school. In the first place, all the graduates were boys whose parents were too poor to give them a technical education. They were admitted to the school, given free board and lodging, and provided with the best instruction obtainable along the lines laid down, and when they had completed the course they were qualified to fill positions which pay them from $18 to $35 per week. No graduate is required to accept a position for less than $18 per week, and cases were found where in less than six months after leaving the school their wages had been advanced to $25 per week. All graduates are qualified to take up practical work without undergoing a period of apprenticeship, and the fact that the demand for graduates is far in excess of the supply is a strong indication that they are preferred over ordinary shop-trained workmen. This was verified by the employers who were visited in this connection, all of whom attributed the superiority of the graduates to the thorough training they had received in the school. It is hardly necessary to add that this school has proved satisfactory. The

splendid reputation which it has already acquired among the naval architects and shipbuilders of the country affords conclusive proof of its usefulness and easily vindicates the wisdom and judgment of the founder.

TECHNICAL AND CONTINUATION SCHOOLS.

The schools that are here classed as technical and continuation schools differ in one important respect from those classed as trade schools—their purpose is not to teach entire trades, but to give scientific and technical instruction for the betterment of those who are for the most part already at work. The manual practice, therefore, in these schools is entirely lacking, or is only for the purpose of making clear the teaching. Many institutions which teach the practice of trades give also the same kind of instruction as the technical and continuation schools, Pratt Institute being a notable example.

DREXEL INSTITUTE, PHILADELPHIA, PA.

The Drexel Institute was founded in Philadelphia in 1891, by Mr. Anthony J. Drexel, for the promotion of education in art, science, and industry. The chief object of the institute is the extension and improvement of industrial education as a means of opening better and wider avenues of employment to young men and women. In accordance with the founder's desire, however, the plan of organization has been made comprehensive, providing liberal means of culture for the public by means of evening classes, free lectures and concerts, the library, and the museum.

The institute building was dedicated December 15, 1891. It is a magnificent structure, built in the style of the classic Renaissance, or what would be better described as a modern interpretation of Greek forms. It is centrally located on one of the main thoroughfares of the city and within easy reach of the principal street railways.

A beginning was made in some of the departments in February, 1892, and in September of the same year work was regularly begun in most of the departments included in the general scheme of instruction.

The founder's gifts to the institution, as a whole, amount to $3,000,000. Of this sum, $1,000,000 has been expended upon the buildings, with their equipments and appliances. The endowment fund of $2,000,000 is applied in maintaining the instruction. This enables the institute to offer the instruction at extremely moderate and in some cases nearly nominal rates. There is also a number of free scholarships for deserving students.

Besides the instruction provided in the several educational departments, the institute carries on a large and important work through the means of the free public lectures and concerts, which are given during the winter months in the auditorium, which is capable of seating 1,500

people. These lectures aim to furnish opportunities for general culture to the public at large, a work in which the library of 26,000 volumes and the museum are also made to cooperate. The collections of the museum embrace specimens in every department of industrial art. During the past year the attendance at the lectures and concerts has been more than 36,000.

In the administration of the institute every effort is made to bring the opportunities for improvement, which are so liberally provided, within the reach of the largest possible number.

The institute is open to both sexes on equal terms. While students are recommended to enter regularly one of the departments or courses, the same liberal opportunities are provided for those taking special or elective courses.

The evening classes, which are open for six months of the year, from October to March, inclusive, offer instruction and training of the same kind and character, and with all the advantages of the extensive appliances and apparatus, as the instruction and training given in the day classes, and at much lower rates. Systematic courses in all the departments of the institute are organized for the benefit of the evening students, and certificates are granted to those who finish these courses and pass the required examinations.

The work of the institute comprehends eighteen departments, each of which is organized with reference to its special objects and courses of instruction. They are as follows: Fine and applied art; mechanic arts; electrical engineering; science; technical courses in mechanical drawing and machine construction; commerce and finance; domestic science and arts; including separate courses for juniors; normal courses; library school; courses in English; physical training; free public lectures and evening classes in choral music; library; museum, and a department of evening courses. The institute affords a wide range of instruction in many useful branches of study. For the purpose of this report, however, only such courses as are specially designed to qualify the graduates to engage either in elementary or advanced work in industrial occupations will be considered in detail.

In the department of fine and applied art are the usual courses preliminary to a thorough knowledge of the application of art to industrial subjects. The following courses have special reference to industrial work: Clay modeling which is adapted to the needs of those desirous of devoting themselves to decorative sculpture in terra cotta and stone as applied to buildings, and also to the needs of artisans and designers in silver, bronze, iron, etc.; a practical course in wood carving and its application to the various forms of industrial production; a three-year course in design and decoration as applied to wall papers, textiles, furniture, book covers, etc., and a two-year course

in architecture, which is designed to qualify the graduates as architectural draftsmen.

The instruction in the department of mechanic arts is of the advanced manual-training order, and aims to give a general rather than a special training. The course in electrical engineering is intended to be both practical and scientific, the particular object in view being to fit the students for positions in which the knowledge gained in the school can be put to immediate and practical use. The course in mechanical drawing is quite comprehensive and is intended for the training of mechanical draftsmen. The course in machine construction provides instruction in the theory of machinery and practical training in the designing and construction of machines.

The courses in domestic science include general and invalid cookery, housekeeping, laundry work, normal and junior courses, etc. These courses are intended for girls and young women who desire to prepare themselves for household duties, nurses, and those who wish to become teachers or directors in this branch of work. The domestic arts department gives instruction in hand and machine sewing, dressmaking, and millinery.

The library school is organized to furnish opportunities for the systematic training of librarians and assistants. The normal courses for the training of special teachers provides instruction for both men and women with a view to qualifying them as teachers in manual training, domestic science and art, and commercial branches.

The charges for tuition range as follows: Day classes, per term—Drawing, painting, and modeling, $12 to $15; clay modeling and wood carving, $15 each; illustration, $20 to $25; design and decoration, $15 to $20; architecture, $30 to $35; special art classes, $15; mechanical drawing and machine construction, $25 each; electrical engineering, $37 and $38; chemistry, $12; physics, $10 to $12; mathematics, $10. Evening classes, per term—Free hand drawing, drawing from the antique, clay modeling (elementary and life classes), and wood carving, $3 each; life class for men, $6; architectural courses, $4 to $6; applied electricity, $5 and $6; mathematics and shopwork courses, $3 to $5 each; mechanical drawing, $3; chemistry and physics, $5 each; sewing, $3; millinery, $3 to $5; dressmaking, $3 to $8.

The courses of instruction are as follows:

DEPARTMENT OF FINE AND APPLIED ARTS.

The general course of instruction in this department comprises free-hand and linear perspective; cast and antique drawing; sketching from objects and the costumed figure; clay modeling; life and still-life work; composition; painting in oil and water color; illustration, etc. The special courses include clay modeling and wood carving, as adapted to the various forms of industrial production; ornamental design and decoration; the graduates course, which includes applied work in architectural

and interior decoration, designing furniture, mantels, stained glass, ornamental iron-work, etc. The course in architecture is as follows:

Architecture.

First year: Study of the orders of architecture from Vignole, and actual examples. Perspective—theoretical principles and practical exercises. Shades and shadows. Sketching from photographs, casts, and buildings, in pencil. Historic ornament—Greek, Roman, Byzantine, Romanesque, Moresque, Gothic, and Renaissance, in line and color. Building materials—kinds and qualities of materials used for building purposes. Building construction—working drawings and principles of heating, ventilation, and plumbing. Graphic statics—essential elements for practical work. Mathematics—review of arithmetic, giving special attention to decimals, ratio and proportion, percentage, square root, metric system, practical measurements; elementary algebra through simple fractions; algebra through quadratics; practical geometry. English—principles of composition and exercises in writing. General history—ancient, medieval, and modern. Building laws—the more important statutes on the subject.

Second year: Architectural design. Planning of domestic and business buildings. Architectural ornament and decoration. Measured drawings from actual measurements of buildings. Constructive design, applied statics, strength of materials, with laboratory work. Sketching in pencil and wash. Pen and ink rendering—reproductive work and original design. Water-color rendering—actual buildings and original designs. Stereotomy. Mathematics—essentials of plane trigonometry, including drill in use of logarithmic tables and solution of right and oblique triangles; practical geometry and mensuration; elementary mechanics; elements of plane surveying and leveling, recitation and field work. Wood turning—designing and shopwork. Specifications; contracts; estimates. Lectures on history of architecture, electric lighting, heating, ventilation, and plumbing. Business forms and customs.

As occasion requires, visits are made to important buildings, to illustrate the practical application of principles presented in class.

Students attend five days a week, from 9 a. m. to 3 p. m., with an hour's recess in the middle of the day.

Evening classes: The evening classes extend through six months of the year, from October to March, inclusive. Instruction is given in the following subjects: Free-hand drawing from the cast, drawing from the antique, from life, modeling in clay, architectural drawing, building construction, design, pen and ink rendering, water-color rendering, wood carving.

DEPARTMENT OF ELECTRICAL ENGINEERING.

The course of instruction and training occupies two years and includes the following subjects:

First year: Mathematics—analytical geometry and calculus. Physics—gases, heat, light, and sound; lectures and laboratory work. Chemistry—qualitative analysis. Theoretical electricity. Electrical lighting and photometry. Electrical laboratory work. Electrical drawing. Mechanics of machinery. Valve gears. Boilers. Machine shop practice. Mechanical laboratory work. English language.

Second year: Mathematics—calculus. Alternating currents. Electromagnets—dynamos and motors. Electrical engineering. Electrical laboratory work. Chemistry—technical chemistry. Thermodynamics—steam, gas, air. Telegraph and signal systems. Designing work. Telephones. Hydraulics and turbines. The steam engine—its structure and design. Mechanics of materials. Mechanical laboratory work. Papers on electrical subjects. Lectures on electrical measuring instruments and their use, building construction, and business forms and customs.

Evening classes: From the beginning of October until the end of March, there are two courses in applied electricity: (1) A course of one year, embracing the simple theory of the electric circuit and its commercial application in lighting and power distribution, etc., with laboratory work in testing; (2) a systematic course, of two years, embracing lectures on the theory and practical application of continuous and alternating currents.

COURSE IN MECHANICAL DRAWING.

The course extends through two years and includes the following subjects:

First year: Mechanical drawing—the use of instruments; lines and measurements; orthographic projection as far as the intersection and development of prisms; intersections completed; the cycloid, epicycloid, hypocycloid, and involute curves; their application to spur and bevel-gear drawing. Free-hand drawing. Descriptive geometry—lines and planes. Mathematics—review of arithmetic, giving special attention to decimals, ratio and proportion, percentage, square root, metric system, practical measurements; elementary algebra through simple fractions; algebra through quadratics, including only the simplest forms in simultaneous quadratics and radicals; practical geometry. Shopwork—bench work in iron. Students complete the elementary exercises during this term. Elementary exercises in woodwork. Student completes some project which has been designed in the drawing room, including key fitting and scraping a cylindrical surface to a bearing.

Second year: Mechanical drawing—worm and worm gears; solids inclined to both planes of projection and the application of the principles involved to iron-roof construction and quarter-twist belts; work from sketches; complete drawings; the designing of a machine to be constructed in the machine shop. Mathematics—essentials of plane trigonometry, including drill in use of logarithmic tables and solution of right and oblique triangles; practical geometry and mensuration; elementary mechanics; elements of plane surveying and leveling, recitation and field work. Physics—laboratory work, consisting of manipulation and measurements. Shopwork—woodwork (pattern making); forging, machine work (parts of a machine designed in the drawing room); machine work—worm, worm wheel, and gear cutting.

Evening classes: Course I—use of mathematical instruments, orthographic projections, intersections, development of surfaces. Course II—the application of the development of surfaces to machine construction, detailed working drawings of machinery. Course III—practical designing of machinery.

COURSE IN MACHINE CONSTRUCTION.

The course of instruction occupies two years and includes the following subjects:

First year: Shopwork—bench work in iron; students complete the elementary exercises during this term, and some project which has been designed in the drawing room, and unless the realization of the project includes key fitting, special instruction is given in the same; elementary exercises in woodwork. Mechanical drawing—the use of instruments; orthographic projection as far as the intersection and development of prisms; intersections completed; the cycloid, epicycloid, hypocycloid, and involute curves; their application to spurs and bevel gears; logarithmic and Archimedean spirals and their application to cams. Mathematics—review of arithmetic, giving special attention to decimals, ratio and proportion, percentage, square root, metric system, practical measurements; elementary algebra through simple fractions; algebra through quadratics, including only the simplest forms in simultaneous quadratics and radicals; practical geometry. Physical training in the gymnasium twice a week during the year.

Second year: Shopwork—woodwork (pattern making); forging; machine work, both in operating and constructing, assembling, worm and gear work. Mechanical drawing—sketching from machines; making assembled drawings of machines from

sketches; worm and worm gears; problems in the construction of machines; graphical representation of forces acting in machines. Mathematics—essentials of plane trigonometry, including drill in use of logarithmic tables and solution of right and oblique triangles; practical geometry and mensuration; elementary mechanics; elements of plane surveying and leveling, recitation and field work. Physics—laboratory work, consisting of manipulation and measurements. Physical training in the gymnasium twice a week during the year.

Evening shop-work courses: (1) Woodworking—exercises in joinery, turning, pattern making. (2) Bench work in iron—chipping and filing. (3) Machine construction—use of machine tools and practical work in the building of machinery. (4) Forging—exercises in forging and welding, forging and tempering of machine tools, ornamental work from designs.

The science courses embrace thorough instruction in mathematics, physics, and chemistry. A part of the latter course consists of special lectures on textiles, dyeing, bleaching, and cleansing materials and operations.

COURSE IN HAND AND MACHINE SEWING.

The course in sewing includes the simple stitches used in hand and machine sewing and their application in the making of garments. Work cut and planned in the class room must be completed at home. All materials are supplied by the student. Students who have not had the necessary preliminary training or experience in hand and machine sewing are expected to take this course, in whole or in part, before beginning the dressmaking work. The course occupies two terms. Two lessons, of two hours each, are given weekly. Applicants must have a good elementary education. The subjects are as follows:

First grade: History of implements used in hand sewing; kinds and qualities of materials for undergarments; proper position of the body in sewing; methods of using thread and needles, thimble, and tape measure; woven textiles; different kinds of stitches; combination of stitches; seams, hems, tucks; buttonholes; making simple garments. Second grade: Sewing machines; measurements; drafting drawers, underskirts, and nightgowns; making of garments; cutting and making corset covers from patterns; cutting and making shirt waists.

COURSES IN DRESSMAKING.

General course.

The general course of instruction consists of four grades, each occupying one term, or half the academic year. Each grade is complete in itself, but the four consecutive grades are essential to thorough training in the practice of the art.

First grade: This grade is devoted to the fundamental principles of dressmaking. One plain dress is completed. Two lessons, of two hours each, are given weekly. The subjects studied are as follows:

Implements and appliances used in dressmaking; cotton staple, its various uses; choice of materials; textiles as to color and application to dress; taking measurements; drafting foundation skirt; drafting draperies and principles of same; finishing skirt for trimming or draping; making lined skirt; form, proportion, and line relating to ornament in dress; plans for completing skirts; cutting waists with seams from patterns drafted by students of the advanced grades, from measurements taken from different members of the class; basting, fitting; planning trimming; general finish.

Second grade: In this grade attention is paid to taking measurements of different figures and to drafting patterns from the same. The first dress made is of plain material; the second is a waist or entire garment of striped or plaid material; the third, a garment on the gown form. The outline of the course is as follows:

Color and textiles; their various uses and relations to personal adornment; growth of wool and silk, manufacture of fabrics; taking measurements; drafting plain waist

from different measurements; drafting waist with extra seams for large figure; cutting and matching striped, plaid, or figured material for waist; making and trimming the same; drafting and making dresses on the gown form; artistic dress in its relation to the body; design in drapery; making dress on gown form from the student's own design.

Third grade: The work of this grade is chiefly an extension of that of the two preceding grades, with the additional subjects of instruction named below. For further practice, students may receive and execute orders. The course of study is as follows:

Advanced drafting; choice of materials for gowns of special character; making dinner dress; evening dress; choice of materials for same; handling of velvet; making models of inexpensive materials to test the design; the form and poise of the body in their relation to dress; child's dress, materials, drafting, cutting, and making the same.

Fourth grade: This grade completes the general course. It includes instruction in tailor finish, as applied to dresses, jackets, and coats. Orders may be received and executed by students. The outline is as follows:

Material used in making coats, as staple and manufactured; drafting jackets and coats of various styles; cutting, basting, fitting, pressing; practice in making pockets, applying same to garment; making buttonholes; sewing on buttons; lining and finish of coat; making collars; principles applied to tailor-made dresses.

Technical course.

This course extends through one year and comprises all the work of the general course. It provides additional practice in executing orders, which students may take on their own account during the second half of the year. Attendance is required every day, except Saturday, from 9 a. m. to 1 p. m. Students have the use of the dressmaking rooms until 4 p. m. Students receive the full course of instruction in drawing and water color, and in the keeping of accounts, business forms, and correspondence, given in the general course. Students taking this course are expected to attend the courses of lectures in the chemistry of textiles, dyeing, and cleansing, and in physiology and hygiene with reference to dress. No additional fee is required.

MILLINERY.

General course.

The general course in millinery consists of three consecutive grades, each occupying one term. In each grade two lessons in millinery, of two hours each, are given weekly. This course also includes instruction in drawing and water color, for the purpose of giving the students a knowledge of line and form, and the ability to execute designs for the various kinds of hats in monochrome and color. One lesson of one and one-half hours is given each week throughout the three grades. Instruction is also provided in accounts, business forms, and correspondence, two lessons a week being given throughout the grade in which the work may be taken. A course of lectures in the chemistry of textiles, dyeing, and cleansing is given in the second term of each year. All materials used are selected and furnished by the students. Constant use is made of the extensive collection of books in the library and of the important collection of textiles in the museum. The leading American and foreign fashion periodicals are supplied in the millinery rooms.

First grade: In this grade the work begins with the study of the hat in detail. The methods of preparing the various fittings for the brim are taught upon a straw and a felt hat, canton flannel and cheese cloth being used which represent, respectively, velvet and crepe. After each exercise of fitting the brim, the hats are trimmed with suitable bows of sateen, which serves as ribbon. The knowledge so gained is then applied in the making of one hat of choice materials. The outline is as follows:

Color and materials as related to the headdress; wiring; folds; fitted facing; shirred

facing; puffed edge; bows and rosettes; study of line and form as applied to frame making; buckram hat frames; fitted hat made, lined, and trimmed; manufactures of straw and felt hats, velvet, and ribbon explained.

Second grade: In this grade the bonnet and toque are studied, using for practice materials that are appropriate for the purpose. The latter part of the grade is devoted to the making of bonnets and toques of choice materials. The outline is as follows:

Bonnet with plain crown and with puffing, made, lined, and trimmed; bonnet of more complex design; toque made, lined, and trimmed; practical work, regulated by the season in which the grade is studied, and leading to a knowledge of the designing of bonnets and hats. At least four pieces of millinery must be made by each student.

Third grade: Throughout this grade students work in choice materials, to gain confidence and experience; they are allowed to receive and execute orders. The outline is as follows:

Crepe bonnet; silk bonnet or hat; growth and manufacture of silk explained; wire frame making; large velvet hat; evening bonnet from student's own design; shirred hat.

Graduate work: Students who have finished the three grades of the general course may remain another term for the purpose of doing more original work and gaining additional practice in dealing with the designs and materials appropriate to the two millinery seasons. The work may consist largely of orders taken by the student.

Technical course.

The technical course occupies one year. Attendance is required every day in the week, Saturday excepted.

Evening classes: In the evening classes, instruction is given in the first, second, and third grades of the general course in dressmaking, and in the first and second grades of the general course in millinery. Each grade occupies one session. There is also a class in sewing. In each grade two lessons of two hours each are given weekly.

The institute is under the general management of a president and board of trustees. There are about 70 instructors, 50 of whom are engaged in the courses covered herein. A large number of the instructors are professional teachers, college and technical school graduates, whose training has been supplemented with long experience in practical work in the parts they teach.

The following table shows the number of pupils in various courses during the past year:

PUPILS IN SELECTED CLASSES IN DREXEL INSTITUTE.

Courses.	Day classes.	Evening classes.	Total.
Drawing, painting, and modeling	100	89	189
Illustration	34		34
Clay modeling		17	17
Wood carving		7	7
Design and decoration	30		30
Architectural courses	17	138	155
Electrical courses	22	62	84
Mechanical drawing	34	118	152
Machine construction	14	40	54
Wood working		11	11
Mathematics		122	122
Chemistry		51	51
Sewing and dressmaking	119	76	195
Millinery	50	31	81
Total	420	762	1,182

Including the evening classes, the number of pupils that have completed the foregoing courses is about 500. The total cost of maintenance is $140,000 per annum. Of this amount it is estimated that about 70 per cent is required for the art, industrial, and technical branches. The institute derives its income from an endowment fund provided by the founder, and from tuition fees.

Regarding the courses of training and study, it is stated that they are quite satisfactory. The management has always aimed to maintain a high standard of efficiency in everything pertaining to the institute. The only thing needed at present is additional class room, and this will soon be provided, as plans have already been made for a new building which will occupy a convenient site adjoining the institute building. Generally speaking, the institute has done a great deal toward furnishing some of the local manufacturing establishments with a class of workmen who are well equipped in the theory and technique of the trades. The influence of the institute upon the working classes generally is a hard matter to estimate. It is safe to say, however, that through its schools, library, and public lectures it has aided in promoting the general intelligence and social development of all classes in the community. The effect upon those who have been under instruction is said to have been beneficial in every respect. The thorough technical training given to the students make them more valuable to their employers, and they are preferred over ordinary apprentices and workmen. A forcible illustration of the value of this training to the students is furnished by one of the largest industrial establishments in the city. In this establishment a reduction of two years from the usual period of apprenticeship is allowed to young men who complete the technical courses in the institute. The success of the institute has had no effect in the way of causing improvement in shop training in the vicinity. On this point it is said, "the ideal of the average shop is purely commercial, and thorough training is subordinated to quick results. The workmen are given special parts to perform and therefore do not acquire a full knowledge of the trade. Everything is done with a rush and the thorough training of the all-round mechanic is lost sight of."

In dressmaking, millinery, and in some trades which require technical skill and a knowledge of architectural and mechanical drawing, it is possible for the graduates to engage in practical work without undergoing the usual period of apprenticeship. The institute schools have met with a high degree of success and have practically attained the end for which they were established.

SPRING GARDEN INSTITUTE, PHILADELPHIA, PA.

The Spring Garden Institute was incorporated in Philadelphia, April 12, 1851. When the school was first started it was intended merely to teach industrial drawing and design. Subsequently a mechanical

handiwork school was organized, and finally a school of applied electricity was added, which is strictly speaking a technical school. Each school or department is complete in itself. The special need that led to the establishment of the school was that mechanics were unable to read the drawings of mechanical draftsmen, and it was the opinion of the founders that they could be made more useful to their employers and more valuable to themselves by being trained in the principles of linear representation of objects.

Both day and evening classes are conducted in each department. The night classes generally are intended to be helpful to apprentices and mechanics who are employed in industrial establishments during the day. The classes are not intended to produce architects, mechanical draftsmen, or artists. The chief purpose always kept in view is to give the pupils such technical instruction as will make them more useful as mechanics. Nevertheless, out of these night schools have come architects, engineers, draftsmen, and artists. The day schools are for those who desire a thorough art or mechanical training before entering a trade or profession. The outcome is the same as in the night classes, but because of the longer time devoted to study the pupils receive fuller instruction and a larger proportion advance to the professions.

The institute library contains a large collection of reference and textbooks on art, mechanical, and engineering subjects which are always accessible to the pupils. The mechanical and electrical equipment comprises a full complement of working tools for each pupil, a complete assortment of wood-working and metal-working machinery, dynamos, motors, transformers, and an air-brake outfit; and for the study of electric traction a complete street car truck, equipped with two 30-horsepower motors, has been installed. In addition, the institute lighting and power plant, with both alternating and direct current systems of lighting, steam and gas engines, boilers, pumps, etc., is especially arranged and adapted to give the pupils a thorough insight into this line of work.

The regular school year, which is divided into three terms of twelve weeks each, begins the middle of September and ends about the middle of June. There is also a special summer term lasting twelve weeks, which is intended for the benefit of those who desire to study during the vacation period. The regular course of instruction covers a period of three years.

The studies in the day art school provide for a fixed course of freehand, mechanical, and architectural drawing, pen and ink work, painting in oil and water colors, industrial designs as applied to wall papers, textiles, stained glass, book covers, etc. This course is arranged as nearly as possible in progressive order. Sessions are held five days each week from 9 a. m. to 2 p. m. The studies in the night art school

cover practically the same ground as those of the day school, except that they are on the elective basis. Sessions are held two nights each week from 7.30 to 9.30 o'clock. Lectures on geometry and perspective are given one evening each week throughout the season, which the pupils of all classes are expected to attend.

The instruction in the mechanical department comprehends courses in wood and metal working. During the first year pupils are assigned to either wood or metal work for the first term, at the end of which they are shifted, so that by the end of the second term all pupils will have had elementary training in both wood and metal working. Beginning with the second year the pupils are required to make a choice of the class they desire to enter, and thereafter the instruction and shop practice is confined to wood or metal working, as they may elect. This method gives the pupils the benefit of continuous work with one kind of tools and enables them to attain greater proficiency in the particular branch they may desire to follow. In the metal-working division the second and third year courses include general machine work, tool making, and machine construction, and in the wood-working division general pattern making is taught.

All pupils in the mechanical and electrical departments receive instruction in mechanical drawing and mathematics. Sessions are held six days in the week, from 8 a. m. to 5 p. m., except Saturdays, when the school closes at noon. The instruction in the night classes is the same as in the day classes, except that the sessions are not divided into terms, and less time is devoted to shop work. There are but two sessions of two hours each per week. The regular course in the electrical department extends over a period of three years for both day and night classes. Pupils in the day class are required to attend the mechanical course also. The instruction is designed to give the pupils a thorough knowledge of the elementary principles of electricity and a practical working knowledge of electrical machines, instruments, and appliances. During the first year of the day class the mechanical shop work is supplemented by a course of lectures on practical electricity. In addition to the mechanical shop work in the second and third year courses two days per week are devoted to experimental and practical work in the laboratory and electrical shop. Except that the pupils are not required to enter the mechanical department, the instruction in the night class is conducted on the same general lines as in the day class. The sessions and hours for instruction are the same as in the mechanical department.

In addition to the regular course there is a special evening course in dynamo and motor construction and testing.

The charges for tuition are as follows: Day classes, per term, drawing, designing, etc., $20; mechanical and electrical departments, first year $25, second and third years $30, summer term $20. Evening

classes, free-hand, mechanical, and architectural drawing, and designing $5 per term; mechanical department $5; electrical department, first year $10, second year $15, third year $20; special course in dynamo and motor construction $25.

The institute is under the control of a board of managers. There are 14 instructors, all of whom have had many years' experience in practical work, and a majority are also graduates of technical and scientific schools. The number of pupils in the different classes during the past year was as follows:

PUPILS IN EACH CLASS IN SPRING GARDEN INSTITUTE.

Courses.	Class.			
	First year.	Second year.	Third year.	Total.
DAY SCHOOL.				
Drawing, designing, etc.	11	5	7	23
Mechanical department	25	15	8	48
Electrical department	25	5		30
Total, day school	61	25	15	101
NIGHT SCHOOL.				
Free-hand drawing	140	80	60	280
Mechanical drawing	45	45	48	138
Architectural drawing	20	14	10	44
Designing (for those who have studied free-hand)			15	15
Mechanical department	40	20	15	75
Electrical department	105	25	10	140
Total, night school	350	184	158	692
Total, day and night schools	411	209	173	793

It is estimated that there have been about 3,000 graduates since the school was established. The building and equipment cost $200,000. The original building was dedicated in 1852. The average cost of maintenance is $16,000 per annum. The institute derives its income from tuition fees and an endowment fund which at present amounts to $158,600. Thirty rooms, with an aggregate floor space of 29,000 square feet, are devoted to the use of the schools.

Regarding the courses of training and study and the benefits resulting from the establishment of the schools, it is said:

The only improvement aimed at is to apply more thoroughly the principles of the school—the teaching of "things rather than words"—and the progress in this direction is entirely satisfactory. In a great city filled with manufacturing establishments it is impossible to trace the influence of a single school upon industries. All that can be learned on the subject is that the institute has contributed its full share toward furnishing the industries with a better class of workmen than they would have without its educational influence. While probably two-thirds of the pupils are sons of mechanics who have learned by bitter experience that want of knowledge of mechanical drawing and the principles of mechanics is a severe hardship, the labor unions have never taken any action regarding the schools.

There is no record of former pupils, though some of the reports show that many of them have advanced to high positions. It would be wrong, however, to ascribe their success to the institute, for a great deal depends upon the man himself. The institute has helped these successful men by giving them sound elementary training, and they were prepared to take advantage of the opportunities offered and worked out their own advancement.

Better wages and more rapid promotions have unquestionably resulted from the training received by the pupils, and they are preferred over ordinary apprentices. The institute has more applications for employees than it can fill from its graduates, and really suffers from the demands made upon it, because some pupils are taken by manufacturers before they have obtained as much training as the institute could and ought to give them. No graduate is fitted to work as a master mechanic. They have not the "commercial speed" which comes of long practice. But the dullest graduate has a far better knowledge of the technique and principles of the trades than the average mechanic and will excel him in the long run. The institute schools have proved highly satisfactory, and have fully attained the end for which they were established. The original purpose was to afford instruction and training that would qualify the graduates to enter the trades and become good mechanics. This, and more, has been accomplished, for the most successful graduates invariably seek more agreeable and better-paying positions as draftsmen, engineers, and designers.

GENERAL SOCIETY OF MECHANICS AND TRADESMEN, NEW YORK, N. Y.

The General Society of Mechanics and Tradesmen of New York City first took up the work of education about the year 1820. Primarily the school was intended for the gratuitous education of the children of indigent and deceased members of the society only, but it grew in such favor that other children were admitted upon payment of a moderate sum for tuition. This plan was successfully continued until the increasing merits of the public free schools rendered it no longer necessary, and in December, 1858, it was discontinued. In January, 1859, the society established the present evening school for the purpose of enabling those engaged in daily occupations to acquire gratuitous instruction in free-hand, mechanical, and architectural drawing, modeling in clay, elementary mathematics, and physics. In addition to the regular class work, the pupils have the benefit of technical lectures on subjects pursued in the class room.

Tuition is free to any young man 16 years of age and over and of good moral character.

For a number of years past the society has maintained 19 free scholarships in the New York Trade School. These scholarships are awarded annually to such deserving applicants as, by their position in life, would be materially benefited by acquiring a knowledge of a skilled trade.

The school term begins the latter part of September and ends the middle of April. Sessions are held four evenings each week. The hours for instruction are from 7.30 to 9.30 o'clock. The courses of instruction are as follows:

MATHEMATICS.

Instruction is given three evenings a week in the following subjects: Arithmetic, algebra through quadratics, plane geometry, and plane trigonometry. The aim in the mathematical classes is to offer work of a practical nature bearing upon the problems confronting the student in his everyday work. A knowledge of mathematics is essential to an intelligent pursuit of study in physics and mechanical or architectural drafting; therefore students in these classes are encouraged to take preliminary work in mathematics.

MECHANICAL DRAWING.

First year (two evenings a week): Elementary principles of mechanical drawing; principles applied in simple working drawings; developments and intersections; isometric drawing; working drawings; tracings; talks on shop methods and blue printing.

Second and third years (three evenings a week): During the second and third years an opportunity is afforded to follow any one of the following special lines of mechanical drawing: Machine-shop drafting; yacht drafting; Patent Office drafting; mechanism—drafting of gears, cams, engine details, valve diagrams, etc.; drafting in connection with electrical industries; lettering (one year); drafting for cornice makers and sheet-metal workers.

ARCHITECTURAL DRAWING.

First year (two evenings a week): Preliminary course in projections; detail drawings of windows and doors; cornice details; various details in frame construction; masonry details—chimneys, arches in brick and stone; isometric perspective.

Second year (three evenings a week): Plans and elevations of houses, preference being given to city conditions; exterior and interior details in various materials; the orders of architecture.

Third year (three evenings a week): Course continued along the lines of the second year's work, but of a more advanced character; elements of architectural design; perspective; study of a school, library, or church; shades and shadows; historic ornament; original work in ink and wash.

During the course frequent talks are given, with blackboard illustrations, on modern steel construction as applied to high structures, foundations, the laws relating to buildings, and the formulas for ascertaining the strength of various materials used in building construction. The last two months are devoted to a graduation drawing.

FREE-HAND DRAWING.

Two evenings a week during the first two years and three evenings a week during the third year.

First year: General free-hand drawing in pencil and charcoal, designed to meet the needs of the individual student in the particular branch of his daily occupation. Drawing from ornament and details of human figure.

Second year: Drawing from the antique.

Third year: Drawing from life.

CLAY MODELING.

Two evenings a week. Students in this course are required to take two evenings a week in free-hand drawing.

First year: The rudiments of clay modeling; first principles governing the construction of ornamental design; use of geometrical figures and their combination in design; introduction of study of natural foliage and its combination with geometrical figures in decorative design. The conventionalizing of natural foliage into ornament; the meaning and origin of the various styles used in ornamental design and their development; the orders and their development.

Second and third years: Instruction in modeling for professional purposes graded according to pupil's trade or occupation. The attaining of a thorough understanding of the treatment of plastic ornament in the various styles, studied exclusively from casts. Figures, masks, and animal forms combined in ornament; modeling from design or photographs; free composition in design.

PHYSICS.

A one-year subject preparatory for special work in electricity, mechanism, heating and ventilation, and building construction. Three evenings a week.

First year: Principles of mechanics, light, heat, and electricity, including the properties of matter; laws of work, motion, energy; determination of specific gravity; pressure and density of fluids; the steam engine; magnetism; laws of electric currents and electrical measurements. One hour each evening is devoted to this subject and students are required to attend the class in mathematics during the other hour, or offer an equivalent.

The school is under the general management of the General Society of Mechanics and Tradesmen. There are 10 instructors, 7 of whom are college graduates and 3 whose training was obtained in practical work. The number of pupils in each class during the past year was as follows:

PUPILS IN EACH CLASS IN THE EVENING SCHOOL OF THE GENERAL SOCIETY OF MECHANICS AND TRADESMEN.

Courses.	Elementary class.	Advanced class.
Architectural drawing	70	32
Mechanical drawing	77	20
Free-hand drawing	66	26
Clay modeling	.....	34
Mathematics	.....	70
Physics	.....	63
Total	213	245

The record of graduates is incomplete, but it is estimated that at least 6,000 pupils have completed the different courses. The building in which the school is held is owned by the society and was dedicated January 3, 1900. More than two-thirds of the entire floor space of the building is devoted to school purposes, and the value of this part, together with the equipment, is estimated at $300,000. The cost of maintenance is about $7,500 per annum, and is provided by the society.

In the opinion of the officials, the present courses of training and study can not be improved upon. It is felt that the school has performed invaluable service for mechanics and workingmen generally. The classes have always been made up very largely of mechanics and their sons, and though obliged to work at their trades during the day,

they have been glad to take advantage of the opportunity afforded by the school to devote their spare time in obtaining technical instruction which could not be had in the workshop. The effect upon those who have been under instruction has been most satisfactory. Higher wages, steadier employment, and more rapid promotion have invariably come to those who have completed the courses. It is stated that the graduates are preferred over shop-trained apprentices and workmen because their technical training, which is taken in conjunction with practical work in the shop during the day, makes them superior workmen, and they show greater aptitude to do more difficult work than those mechanics who neglect to acquire a knowledge of the technical principles which apply to their respective trades.

A large proportion of the pupils are mechanics and apprentices who are already engaged in trades which require a knowledge of drawing, and they attend the school for the purpose of becoming proficient in that part. Those who study drawing with the intention of following it up as a means to a livelihood must also devote some time to obtaining practical experience before they are competent to take up regular work. As a rule this class of graduates start in under instruction in a drawing-room and work their way up.

This school has proved satisfactory in every respect and has fully attained the end for which it was established.

ROCHESTER ATHENÆUM AND MECHANICS INSTITUTE. ROCHESTER, N. Y.

The Rochester Athenæum and Mechanics Institute, of Rochester, N. Y., is the result of a consolidation of the Rochester Athenæum, which was organized in 1830, with the Mechanics Institute of the city of Rochester, which was organized in 1885. The consolidation was effected June 4, 1891. The corporation has since been most popularly known by the latter portion of its title. It is said that the inception and largely the extension and upbuilding of this modern institution of learning is due to one of the leading manufacturers of Rochester, Mr. Henry Lomb. Employing from 700 to 800 workmen, in a business that required the highest kind of mechanical skill, Mr. Lomb had experienced the obstacles attendant upon the prevailing meager system of technical education. He found that there was not only a lack of good mechanics, but that when he needed men of high technical skill it was necessary to send abroad for them. In common with other manufacturers, Mr. Lomb felt that there should be some place near by where apprentices and mechanics, and young women also, could receive such technical instruction as would not only be useful in ordinary branches of industry, but would also result in creating a class of artisans who would compare favorably with the technical experts who are trained in foreign schools. The importance that was attached

to the matter is best illustrated by the paper which was circulated for signatures among the manufacturers. It was as follows:

We, the undersigned, manufacturers and employers, consider the establishment of free evening schools in this city for instruction in drawing, and such other branches of studies as are most important for industrial pursuits, of great advantage to our people. We believe that, besides the immediate benefit these schools would bring to many, they would greatly assist in gradually securing to our city the technical instruction and training which brings so valuable and beneficial results wherever it exists, and which is admitted to be of vital importance to our country. We consider it proper that our manufacturers and employers should take the first step in this matter, and cordially invite them and all those who take an interest in this undertaking to meet in the common council room to consult about the best ways and means for the establishment of such school, as well as other matters which may assist practical education.

Shortly after this the following was put forth from the University of Rochester, signed by the president and others:

We learn with great interest of the movement now in progress among the manufacturers of this city toward the establishment of a school of technical drawing and other studies bearing upon industrial pursuits. We are thoroughly convinced that the general influence of such a school can not fail to be salutary, while its special and direct bearing upon many branches of industry must be beneficial in an eminent degree. The distinction which is beginning to be accorded to this city on account of its great variety of industries and the superiority of many of its manufactured products renders it fitting as well as necessary for the maintenance of this distinction that such a course of instruction should be immediately established and generously sustained. It would not only develop the talent of our young artisans, but also attract to this city the best talent of the country. We therefore desire to express our most cordial sympathy with this movement, and give it our most earnest commendation.

The circulation of this paper resulted in several meetings, and finally, on the 21st of October, 1885, the Mechanics' Institute was founded. The object of the institute, as stated in its charter, is "to promote such practical education as may enable those persons receiving instruction to become better fitted for their occupation in life. The means by which it is proposed to carry out this object shall be the establishment of a school for drawing and designing, the giving of lectures and holding of discussions on practical subjects, and such other instruction as may be found useful in furthering the aims of the association." The school was formally opened on November 23, 1885, when more than 400 applicants enrolled their names, and classes were formed at once. During the time that the institute has been in existence it has given instruction to more than 24,000 pupils. Although its growth has been somewhat phenomenal, the institute has carried on its work in detached buildings which were poorly adapted for the purpose, and a hope of

the future had always been that some time, by the combined efforts of its friends, it might be established in a commodious and thoroughly equipped structure. Through the generosity of one man this hope is realized, and the institute now occupies one of the most modern school buildings in the country.

The magnificent new building, erected at a cost exceeding $200,000 and presented to the institute by Mr. George Eastman, was formally opened for inspection by the public April 15, 1901. The building is three stories in height and has a floor space of 2⅔ acres. It is constructed of red brick, with steel beams and trusses for floors and roof, and in point of adaptation for its purposes it may be pronounced perfect. The heating and ventilating systems are of the most modern type. The heat is distributed by a giant fanning system, which carries it to the most remote corners of the building, yet by a system of automatic regulators it is possible to raise the temperature of any room to a desired point, regardless of conditions in all other apartments. The system of ventilation is so perfect that the entire quantity of air throughout the building can be changed every ten minutes.

The requirements for admission are as simple as possible. The classes are open to all, without distinction of color, creed, nationality, or sex. The regular school year opens in September and closes in June.

The courses of study are divided into two departments, namely, a department of industrial and fine arts and a department of domestic science and art. In the latter department there are three terms of three months each in day and evening classes. The courses comprehend every branch of domestic work and, except the dressmakers' training class, are intended chiefly for those who desire instruction for home use, and for teachers. The work in the department of industrial and fine arts is arranged to meet the requirements of three classes of pupils, namely: (1) Those who are employed otherwise during the day and attend only in the evening; (2) those who can devote only one or more days a week, taking special branches; (3) those who attend five days a week and wish to pursue a full course of instruction. The work in the separate evening classes in this department is arranged to cover three years, with sessions two evenings each week, for one term of seven months, extending from the latter part of September to the latter part of April each year. Pupils from the public schools are not admitted to the evening classes in this department. The advanced classes are open only to those who have completed the previous year's work, or its equivalent. The day courses are divided into three terms of three months each. The work in each class covers a full course of instruction in the branch taken, and may be completed in from one to three years, according to the number of hours per

week devoted to it and the aptitude of the pupil. In addition to the regular terms, there is a short summer term lasting from July 8 to August 3. Besides the industrial and art courses in the day school there is a mechanic arts course of high-school grade, a part of which is devoted to manual training, a separate manual-training course, normal courses, and Saturday classes for teachers and pupils of the public schools. As such courses do not come within the scope of this report, they will not be considered in detail.

The courses of study include free-hand, mechanical, and architectural drawing, ornamental design, composition and pen and ink drawing, drawing from life, painting in oil and water color, china decoration, lettering, clay modeling, history of art, mathemathics, physics, chemistry, electricity, statics, steam engineering, industrial training in wood and in iron. A fourth-year class in machine design has been added to the course in mechanical drawing, which will include a study of mechanism, valve motion, machine construction, etc. In the architectural course the aim is not so much the study of architecture as that of building construction. The course in ornamental design includes a study of historic and modern ornament, conventionalization, composition, geometrical arrangements, etc. The advanced classes take up applied design. The work in free-hand drawing, composition, and pen and ink drawing is intended to develop the creative ability of the pupils and to equip them for practical work in illustration. In steam engineering the work consists of lectures, discussions and problems on steam, boilers, engines, indicators, pumps, and condensers. It is not the aim of the institute to turn out steam engineers, but rather to give those engaged in the work or interested in the study the chance to improve in that line. The course in industrial training in woodwork is designed for those who desire a thorough knowledge of the best methods of performing the various operations in timber framing, bench work, pattern making, and cabinetmaking. The course in industrial training in iron is intended to cover as thoroughly as possible the working of iron and steel and the making of some finished mechanism or machine tools.

The charges for tuition are as follows: Day classes, per term, free-hand, mechanical, architectural, and design drawing, mathematics, and physics, $7.50; life class, pen and ink and composition, $9; history of art, $4; painting in oil and water colors, $9 to $12; dressmakers' training class, $25. Evening classes, per term, free-hand, mechanical, architectural, and design drawing, first-year course, $4; second and third year courses, $5; pen and ink drawing, lettering, clay modeling, mathematics, electricity, and machine design, $6; physics, $10; life class, $12; practical electricity and industrial training in wood or iron, $15; statics and steam engineering, $4; chemistry, $12 for first-year course and $15 for second and third year courses.

The school is under the general management of a board of directors. There are 26 instructors in the courses covered by this report, all of whom have had practical training in their respective branches, and a number are also graduates of the school. The number of pupils in the different classes during the past year was as follows:

PUPILS IN SELECTED CLASSES OF THE MECHANICS' INSTITUTE.

Courses.	Day classes.	Evening classes.	Total.
Free-hand drawing	45	115	160
Mechanical drawing	19	225	244
Architectural drawing		24	24
Ornamental design	21	30	51
Composition and pen and ink drawing	32	20	52
Life class	29	21	50
Painting, oil and water color	52		52
Clay modeling		17	17
Art history	33		33
China decoration	7		7
Lettering		10	10
Mathematics		30	30
Chemistry		16	16
Electricity		59	59
Steam engineering		16	16
Industrial training in wood		27	27
Industrial training in iron		44	44
Dressmakers' training	14		14
Total	252	654	906

The number of graduates is 3,600. The value of the property owned by the institute is about $400,000, 75 per cent of which is devoted to school purposes. The funds for the buildings and equipment were furnished by donations and contributions from the citizens of Rochester. The institute is maintained by tuition fees and contributions from the citizens of Rochester. The cost of maintaining the entire institute is about $40,000 per annum. At least 65 per cent of this amount is chargeable to the courses covered by this report.

The officials feel that the present courses of training and study are entirely satisfactory. It is said that there can be no question regarding the benefits accruing to local industries as a result of the establishment of this school. It has been influential in raising the standard of intelligence and efficiency of the working classes generally, and has been a strong factor in promoting industrial, educational, and social development in the community. This, in fact, is also the testimony of many of the leading citizens and manufacturers. The effect upon those who have been under instruction is said to have been beneficial in every respect. Those who complete the courses have no difficulty in procuring good positions and steady employment. Many of the graduates now hold leading positions in the largest establishments in the city. The graduates are preferred to shop-trained apprentices and workmen, for the reason that, after having a reasonable amount of shop practice, they are better fitted to perform their work. Furthermore, they are able to make better and quicker progress and are more reliable than those who have no technical training. The

position taken by many of the local manufacturers on this point is best illustrated by the fact that they will not employ a young man as an apprentice unless he will attend the evening classes at the institute.

It is thought that the success of the institute and its graduates has led to the improvement of ordinary shop training in the locality. Regarding the ability of graduates who have had no previous shop experience to take up practical work without serving a period of apprenticeship, the opinion of the principal is worthy of attention. He states that the institute does not claim to teach trades to the extent that the graduates can go out and do as good work as those who have spent years in working at the same part or occupation. Very few, if any, of the graduates of the trade or technical schools are qualified to do practical work until they have spent a year or more in execution or shop work. The school can give the theoretical and technical instruction far better than it can be given in the shop, but an opportunity to apply and harmonize the theoretical and technical knowledge with everyday shop conditions and practical work is required before the graduate can be considered competent. Many of the young men and women obtain good positions just as soon as they graduate, but after having one or two years' outside experience they develop more rapidly and receive higher compensation.

The results thus far accomplished have exceeded the most sanguine expectations of the founders of the institute. While the original object has long since been attained, still the constantly changing conditions in the industrial world give rise to other educational necessities which the institute hopes to share in providing for. The commodious new building affords ample facilities for increasing and extending the scope of the work, and the officials look forward to a still greater career of usefulness for the institute.

WELLS MEMORIAL INSTITUTE, BOSTON, MASS.

This institute has been in operation twenty-one years. Its objects, as stated by its constitution, are "to provide working people the means of social intercourse, mutual helpfulness, mental and moral improvement, and rational recreation." Starting in two rooms, it now has a membership of between 1,800 and 1,900 men and women, and uses to the extent of its capacity a five-story brick building. It maintains club rooms, rooms for billiards and other games, a coffee and lunch room, bowling alleys, a trade-discount system, a medical aid association, a benefit society, two cooperative banks, a building association, bicycle and baseball clubs, etc., and carries on mechanical and industrial evening classes and a system of free lectures.

The evening classes include courses in architectural and machine drawing, practical electricity, steam engines and steam engineering, dressmaking, millinery, cooking, and stenography and typewriting.

For these courses there are 8 well-trained instructors. The number of pupils in these courses and the number of those who have completed full courses can not be given, as very few take full courses of instruction. The only fees charged are an entrance fee of 50 cents for each course and the fee of $1 per year for membership in the institute.

The funds for maintaining these classes come from the fees and contributions, and they are managed by the officers of the institute and its superintendent.

The courses are capable of great improvement, both by enlarging the number of subjects taught and furnishing better equipments, but the outlook for this is not especially promising.

The benefits derived from these courses have been in fitting working men and women for better positions, and consequently for better salaries, and in furnishing more intelligent labor to employers.

The courses, especially those in steam engineering, electricity, and drawing, have been attended by a large percentage of labor-union men, and the rest of the educational work has always had the hearty support of organized labor. Higher wages, steadier employment, and more rapid promotion have most decidedly accrued to those who have taken these courses, as a result of their better preparation for work, and such workmen have been preferred by employers to merely shop-trained men, especially in engineering and electricity.

These evening classes have, generally speaking, proven quite satisfactory, and while perhaps they have not fully attained the desired end, owing to lack of means to perfect the courses of instruction, they have been a great help to working people.

NEWARK TECHNICAL SCHOOL, NEWARK, N. J.

The establishment of this institution is due to the Board of Trade of Newark, N. J., taking advantage of a State law enacted in 1881, which provides—

That whenever any board of education, school committee, or other like body of any city, town, or township in this State shall certify to the governor that a sum of money, not less than $3,000, has been contributed by voluntary subscriptions of citizens, or otherwise, as hereinafter authorized, for the establishment in any such city, town, or township of a school or schools for industrial education, it shall be the duty of said governor to cause to be drawn, by warrant of the comptroller, approved by himself, out of any moneys in the State treasury not otherwise appropriated, an amount equal to that contributed by the particular locality as aforesaid for the said object; and when any such school or schools shall have been established in any locality as aforesaid there shall be annually contributed by the State in manner aforesaid, for the maintenance and support thereof, a sum of money equal to that contributed each year in said locality for such purpose: *Provided, however*, That the moneys contributed by the State as aforesaid to any locality shall not exceed in any one year the sum of $5,000

All moneys raised and contributed as aforesaid shall be applied, under the direction of a board of trustees, organized as hereinafter provided, to the establishment and support of schools for the training and education of pupils in industrial pursuits (including agriculture), so as to enable them to perfect themselves in the several branches of industry which require technical instruction.

The school was opened February 9, 1885, in a small building, which was occupied until January, 1897, when it was transferred to a handsome modern structure well suited and arranged for industrial and technical education. The particular object of the school is the advancement of the manufacturing interests of the city and State through the agency of industrial and technical education.

Both day and evening sessions are held. The school year for the evening classes begins the first Monday in October and ends the second Friday in May. In the day classes the year commences on the third Monday in October and continues to the first Saturday in June. An applicant for admission to the first-year class must be at least 16 years of age, of good moral character, and must pass a satisfactory examination in arithmetic, algebra as far as factoring, and physics, or present a certificate of graduation from one of the local grammar schools. Applicants who are not prepared to enter the first-year class may enter the preparatory class, provided they are at least 15 years of age and proficient in arithmetic as far as percentage.

In addition to the above there are two-year courses in theoretical and applied electricity, electroplating, and plumbing.

The sessions of the evening classes are held on five evenings in the week from 7.20 to 9.30, except the classes in the chemical laboratory, in which the sessions begin at 6.30. The sessions of the day classes are held on Monday and Wednesday from 2 p. m. to 5 p. m., and on Saturday from 9.30 a. m. to 12 noon. All text-books and drawing materials must be provided by the students. The courses of instruction are divided into a general and a special course. The latter consists of special studies, or short courses made up of subjects which form a part of the general course. The general course for the evening classes is as follows:

Preparatory: Arithmetic, algebra to factoring; writing and business forms; English composition and physics (properties of matter).

First year: Algebra, to equations of the second degree; theoretical and descriptive chemistry; free-hand drawing, three hours per week.

Second year: Algebra, completed; geometry; free-hand drawing, four hours per week; lectures on agricultural, technical, and physiological chemistry, and laboratory work.

Third year: Geometry, completed; mechanical or architectural drawing, four hours per week; descriptive geometry; physics; dynamics, heat, static and dynamic electricity and magnetism, and laboratory work in chemistry.

Fourth year: Trigonometry; theoretical and applied mechanics; technical chemistry; physics; sound and light; mechanical or architectural drawing, two hours per week.

An applicant for the course in theoretical and applied electricity must be proficient in arithmetic, algebra as far as quadratic equations, elementary physics, and have some knowledge of mechanical drawing, or present a certificate of graduation from a high school. In the plumbing course the applicant must pass an examination in arithmetic and must have worked at the plumbing trade at least one year and bring a letter from his employer to that effect. The object in this course is not to teach the practical work, but to educate the pupils in the theory and principles of the trade.

The instruction in the day classes is devoted entirely to art and, excepting the Saturday class, is intended for women only. The course includes antique and pen and ink drawing, studies of drapery and objects of industrial art, painting groups of still life, flowers and foliage from nature, drawing from the costumed model, etc. For the general course of study there is no charge for tuition to residents of the city, but in the special courses and in all cases where the student is a nonresident a tuition fee is charged.

The school is under the general management of a board of trustees. There are 13 instructors; a majority of them are college graduates, and all have had practical training in their respective branches. The number of students in the school during the past year was as follows: Preparatory class, 36; first-year class, 74; second-year class, 41; third-year class, 20; fourth-year class, 18; theoretical and applied electricity, 10; electroplating, 5; plumbing, 3; post graduates, 4; special students, 23; day students, 21; total, 255. Of this number 236 students were residents of the city and 19 were nonresidents. The number of graduates is 136.

The cost of the building and equipment to date is about $73,000. The funds for erecting the building were supplied by voluntary contributions from local citizens, and the equipment was purchased out of the State and city appropriations. The maintenance of the school requires $12,000 per annum and is derived from the State and city appropriations.

The courses of training and study are satisfactory, though it is stated that the scope of the work might be improved by adding a course in mechanic arts, and a course in designing as applied to small metal goods, such as jewelry and novelties, but owing to lack of funds there is no immediate prospect of this improvement being made. With respect to the effect upon those who have been under instruction, it is said: "The school has certainly increased the intelligence and efficiency of those who have attended it. The habits of precision which are inculcated by the theoretical and systematic training gives the graduates preference over ordinary apprentices and workmen, and as a rule they command higher wages and are in demand not only locally, but wherever one has been employed others are wanted. Most of the

work is of a technical nature and is pursued in conjunction with the trades in which the students are engaged during the day. Those who pursue the studies prior to entering upon practical trade work must also undergo a period of apprenticeship before they are considered proficient. The school has proved very satisfactory and has practically attained the object for which it was established."

VIRGINIA MECHANICS' INSTITUTE NIGHT SCHOOL OF TECHNOLOGY, RICHMOND, VA.

The object of this school is said to be the promotion and encouragement of manufactures, the mechanic and useful arts, and the mental and social improvement of the industrial classes. The fact that mechanics are so generally deficient in a knowledge of the elements of their trades led to the establishment of the school. Instruction is given in the following studies: Arithmetic, algebra, geometry, trigonometry, applied mechanics, bookkeeping, free-hand drawing, architectural drawing, mechanical drawing, naval architecture, chemistry, natural philosophy, electricity, and modeling. During the session of 1900–1901, for which the facts presented herein were gathered, the number taking each study was as follows: Arithmetic, 115; algebra, 24; architectural drawing, 23; bookkeeping, 44; chemistry, 9; electricity, 19; free-hand drawing, 31; geometry, 22; mechanical drawing, 38; modeling, 3; natural philosophy, 2; naval architecture, 2; total, 332.

Pupils are required to pay a membership fee of $3 on entering the school, and to pay for their own books, instruments, etc. Certificates of promotion are issued and diplomas are given upon graduation. Very few of the pupils graduate and obtain diplomas, most of them being working people who do not complete the full course. There are 16 instructors, many of whom have been trained in educational institutions, while others have received a practical training only.

The building used is not owned by the institute, but is rented for $500 per year. The equipment cost about $800. The cost of maintaining the school is $6,000 per year. The funds are obtained in large part from the city and are added to by the membership fee of $3 per individual.

It is believed by the officers of the institute that the school could be improved by perfecting the courses, which are curtailed owing to want of room and money. The prospect of a new building is excellent. A great deal of benefit has accrued to the industries of this section by reason of the dissemination of technical knowledge among the many mechanics who have attended the institute, and this applies to other sections of the country as well, as over 4,600 students, coming from all parts of the United States, have attended the school.

The institute has a reference library that is very valuable to mechanics and architects, and also to those of other trades.

The graduates, and those who have attended the classes without being graduated, are better prepared for work than those who have not received such educational advantages, and in consequence their status is raised, and higher wages, steadier employment, and more rapid promotion have been the usual result.

This school does not teach trades or occupations except in the case of mechanical drawing, etc. It takes the man at his trade and gives him the theoretical and technical side of it. Most of the students are actively employed during the day in the shops. The school has proved eminently satisfactory and has more applicants than it can accommodate in its present quarters. As far as its present facilities will allow, the end for which it was established has been attained.

TECHNICAL SCHOOL FOR CARRIAGE DRAFTSMEN AND MECHANICS, NEW YORK, N. Y.

The Technical School for Carriage Draftsmen and Mechanics was established in New York City in 1880 by the Carriage Builders' National Association. The express purpose of this school is to afford technical instruction to mechanics who are already employed in the carriage industry. It is said that at the time when this school was started all the best carriage designers came from abroad. The promoters had great faith in the idea that a school of this kind would not only be the means of creating a competent class of American designers, but it would also be a benefit to the manufacturers generally by affording facilities for superintendents, foremen, and skilled mechanics to obtain a thorough technical knowledge of the industry.

The requirements for admission provide that the applicants must be engaged in the manufacture of pleasure or business vehicles; they must be 16 years of age or more, and able to speak, read, and write English, and to write a fairly good business letter; they must have a knowledge of arithmetic sufficient to solve problems in proportion and in square and cube root. Some knowledge of geometry is also desired, but it is not required on entering. Examinations for admission usually take place two weeks preceding the opening of the term. Drawing instruments must be furnished by the pupils.

The school year is divided into two terms. The autumn term opens on the first Monday in October and closes at Christmas. The winter term opens on the first Monday after New Year's Day and closes the last Friday in April. Day and evening sessions are held. The day class meets five days each week from 9 a. m. to 4 p. m., and the evening class meets three nights each week from 7.30 to 9.30 o'clock. The day class is limited to 10 pupils and the evening class to 30 pupils. The tuition fee in the day classes is $30 for the autumn term and $40 for the winter term. The fee in the evening classes is $5.

No pupil will be entitled to a certificate of graduation unless he can pass, in the judgment of the trustees, a satisfactory examination in all

the branches taught. He must, upon examination, evince a thorough knowledge of geometry as applied to carriage building, known as the "French rule of drafting;" show facility in making free-hand drawings; be able to make scale and full-size working drawings of carriages; be able to give the proper sizes of the different parts of light, medium, and heavy carriages; and be able to write, clearly and correctly, orders for such parts as are made by special manufacturers, such as wheels, axles, and springs. A knowledge of perspective and colored drawings is also desirable.

The courses of instruction are divided into three classes, namely, an introductory or free-hand class, a class for the study of carriage geometry, and a class for scale and full-size working drawings. The studies comprise linear designing, including free-hand, scale, perspective, colored, and full-size drawing; geometry applied to carriage construction, including the principles of the so-called "French rule;" carriage-body making; construction of carriage gearings; and principles involved in the suspension of carriages.

In addition to the regular class work instruction is also given by correspondence to employees of carriage builders and the trade accessory thereto. This class is kept open during the entire year, and pupils may join at any time. Three terms are required to complete the full course of corresponding lessons, which are 83 in number and are conducted by means of the so-called "Chautauqua system." The cost of the full course is $3 to apprentices and $6 to journeymen and others.

The school is under the general management of the Carriage Builders' National Association. There is but one instructor, and he is a graduate of the school and a practical carriage builder also. During the past year there were 2 pupils in the day class, 28 in the evening class, and 400 in the corresponding class. The number of graduates is 225. The school occupies three rented rooms, with about 1,400 square feet of floor space. The equipment is valued at $1,000 and was furnished by the Carriage Builders' National Association. The cost of maintenance is $2.500 per annum. The school is maintained partly by tuition fees and partly by contributions from members of the Carriage Builders' National Association.

The courses of training and study were specially designed for the carriage industry, and, in the opinion of the officials, need no improvement.

It is said that the school has rendered material aid to carriage builders throughout the country, and has done a great deal toward increasing the intelligence and efficiency of the higher class of mechanics who are engaged in the carriage industry. The effect upon those who have been under instruction has been highly satisfactory. Of the graduates since 1892, 16 per cent are in business for themselves,

16 per cent are holding positions as superintendents, 23 per cent are foremen of departments, 31 per cent are carriage draftsmen, and the remaining 14 per cent are working at their trades under greatly improved conditions.

The technical knowledge obtained by the graduates always results in their receiving preference over ordinary shop-trained workmen. It is said that the success of the school has led to the improvement of ordinary shop training. Most of the graduates are men who have already learned the body-making branch of the trade. When they complete the course some take positions as carriage draftsmen without having to serve a period of apprenticeship, and others are soon promoted to responsible positions.

The school has proved satisfactory in every respect and has fully attained the end for which it was established.

SCHOOL OF MESSRS. R. HOE & CO., NEW YORK, N. Y.

This school was established more than thirty years ago in New York City by Messrs. R. Hoe & Co., manufacturers of printing presses, etc. The need for a school of this particular kind grew out of the fact that the constantly increasing demand for improved machinery made it necessary to have a more intelligent class of workmen in the construction departments. In order to bring about the desired results the company decided to establish a school where the boys and young men employed in the shops during the day might spend a portion of their time in the evening in acquiring a knowledge of such things as would enable them to better understand the work in which they were engaged and which would insure a higher degree of efficiency and ultimately result in training up a superior class of workmen.

Admission to the school is restricted to the apprentices who are serving their time with the company. Tuition is free. The course of instruction covers a period of four years and is carried on in conjunction with practical work in the shop during the day. The school opens the first week in September and closes the last week in May. Sessions are held three nights each week.

The course of instruction includes English, mathematics, geometry, and free-hand and mechanical drawing.

The school is under the general management of the company. There are 5 instructors, 3 of whom are college graduates and 2 are practical machinists who are graduates of this school. There were 60 pupils in the school during the past year, and since the school was started there have been about 1,400 graduates. The school is equipped and maintained by the company and occupies about 3,300 square feet of floor space in the main building. The equipment cost $1,000 and the cost of maintenance is $4,000 per year.

The officials state that the course of training and study is specially adapted to the purpose in view and needs no improvement. The school has been a great benefit to the establishment, and has effected a very decided improvement in the intelligence and efficiency of the workmen. The graduates always receive preference in the establishment and they have steady employment and receive the highest wages. Many of them are now filling important positions in various parts of the country. As workmen they are preferred over any other class because they are better fitted to do the work intrusted to them. It is not known whether the success of this school has led to the improvement of shop training in other establishments, but in this establishment many improvements have been effected through the agency of the school. As the course of instruction is arranged to continue and terminate with the regular period of apprenticeship in the workshops, all the graduates are competent to do practical work as full-fledged journeymen. The school has proved satisfactory in every respect, and has fully attained the end for which it was established.

FREE EVENING DRAWING AND TRADE CLASSES OF THE PUBLIC SCHOOLS, SPRINGFIELD, MASS.

These classes were established to provide for young men desirous of adopting industrial pursuits an opportunity to gain a good knowledge of machinery in order that they might be able to rise in the industrial world. The classes in free-hand drawing and drafting were established over twenty years ago, and classes in tool making, machine-shop practice, and plumbing were started three years ago. These classes are under the management of the school committee of the city and the superintendent of schools.

The object of the free evening drafting classes is to teach mechanics and others, either men or women, the principles of instrumental drawing used by designers, decorators, architects, machinists, and engineers. Those wishing to attend free of charge must reside in Springfield, must not be less than 15 years of age, and must not be members of the public day schools. Nonresidents are charged $10 for the term of twenty-one weeks. The school hours are from 7.15 to 9.15. The outline of the work is as follows:

Beginners' class (two evenings per week): Use of tools and the drawing of plane figures. Orthographic projection of solids, and the principles of same applied to the making of working drawings.

Middle class (one evening per week): The development of surfaces of solids, isometric projection, theory of the screw, and the laying out of practical working drawing, line shading.

Advanced class (two evenings per week): Machine and architectural drawing, class and individual instruction in the principles of cams and gears, the laying out of practical working drawings from models and figured sketches, practice in tracing, and instruction in blue printing. Class and individual instruction in house planning and details of same. Architectural perspective and the coloring of drawings. These

different branches are arranged in a series of courses, covering each subject in such a practical manner as to make it possible for any student to fit himself for a position as draftsman in any of the different trades.

Persons to be admitted free to the evening free-hand drawing classes must be residents of Springfield, not less than 15 years of age, and must not be members of a public day school. Nonresidents are charged $15 for the session. One lesson a week is required.

Elementary class: Still life, simple casts, etc., in charcoal.

Intermediate class: Still life, historic ornament, and casts from details of human figure in charcoal.

Advanced class: Drawing from life in charcoal, pencil, pen and ink, and brush. Pictorial composition.

Applicants for admission to the evening trade classes in tool making and machine-shop practice are required to furnish satisfactory evidence of fitness to do the required work. They must have a practical knowledge of such machines as the lathe, shaper, and drill press, and the tools which accompany them. They must also give satisfactory references. From time to time test pieces of each student's work are subjected to measurements by standard measuring machines. The degree of accuracy in the student's work, as shown by these authorized tests, determines his standing, and forms the basis on which certificates of proficiency are granted. Three of these certificates entitle a student to a diploma. At least three years are required to complete this course. The tuition fee for the term, November to April, is $10 for residents of Springfield, and $20 for nonresidents.

The course of instruction begins with the use of the simpler testing tools, such as calipers, gauges, and micrometers in machine-shop problems. After these preliminary exercises, the construction of simple tools, such as mandrels, twist drills, reamers, butt mills, milling cutters, taps, and dies, is begun. These tools are first finished in the rough, and afterwards tempered and ground to accurate dimensions. They are not accepted unless they are as accurate as tools of their class produced by the best makers.

The next step in the course is the making of standard gauges, such as fixed or snap gauges, standard plugs, and collar gauges. Practice is also given in designing and making special gauges for testing certain parts of the work involved in high-grade manufactured products.

The final steps in the course include the more complex and original processes for which the preceding practice has been a preparation. This work involves the making of machine tools which are to be used in the production of the interchangeable parts of machines. In this class of tools are included jigs, templets, punches, dies, etc. A course of mechanical drawing accompanies the shopwork on the lines necessary to a proper understanding of the details of the mechanical processes.

For the evening trade classes in plumbing the tuition fee for the term is $10 for residents of the city and $20 for nonresidents. The outline of the work in the plumbing classes is as follows:

First year: The theory of plumbing practice—(1) Metals and alloys; solder and its manipulation. (2) Hydraulic rams, how to set and put in operation; practical demonstration. (3) Pumps, single and double acting, how to connect and repair. (4) Water and its distribution; service pipes; friction, adjustage, pressure, and velocity; vena contracta. (5) Water supply; water hammer, cause and remedy; noises in water pipes; air locks in water pipes, cause and remedy. (6) Water regulators; reducing the pressure; practical tests with gauge. (7) Water meters, how to read; sample for practical demonstration. (8) Filters and filtration; samples. (9) Kitchen range boilers, single and double, with various connections, showing faulty and correct method for hot-water circulation; upright and horizontal setting; circulation of water; illustrated with charts. (10) Storage and house tanks; safety and vacuum valves; faucets, how to repair, showing various patterns; freezing of pipes; thawing of pipes. (11) Cottage house plan and specification; city, tenement, and apartment house plans for supply pipes.

Manual instruction—Methods of joining metals; tools, names and uses; straightening pipe; preparing pipe ends; cup joint; overcast joint; making and putting on tacks; cleaning and testing solder; wiping joints, supply pipes only; horizontal and upright, round and branch, 3-way joints; packing bibbs and ball cocks; wiping in and adjusting bibbs for sinks and laundry tubs; setting up and connecting boilers with range and house tank; tank lining and pipe connections.

Second year: Theory of plumbing practice—(1) Heat, ventilation, local and drain; practical demonstration. (2) Drainage system; subsoil drains, cellar drainers; cesspool construction; sewer, drain, soil, and vent pipes. (3) Ventilation of house drains; fresh-air inlets; frozen vent pipes; plenum and vacuum in a drainage system; foul air, where discharged. (4) The siphon and its action upon house plumbing. (5) Traps and siphonage; grease traps; where should a trap be ventilated? (6) Traps tested, showing merits and demerits of the various traps; samples of twelve makes. (7) Fixtures; baths, sinks, urinals. (8) Lavatories; laundry tubs, tank valves. (9) Water-closets; care of plumbing fixtures. (10) Proper arrangement of plumbing fixtures.

Manual instruction—Wiped joints, round and branches, on 1¼ to 4 inch lead pipe, also of angle; wiping on 2 and 4 inch ferrules; wiping side and floor flanges; wiping flanges on traps; wiping joints used in electric conduits; sand bends, springs, etc.; sand bend offsets and angles; soil-pipe joints, upright and horizontal; setting up soil-pipe drainage systems; setting up plumbing fixtures; lead burning.

In the above classes 6 instructors are engaged in teaching. Three of these are teachers of mechanical and free-hand drawing, with a thorough art education gained in the Massachusetts Normal Art School. One has had experience of over twenty years in machine-shop work, 1 is a graduate of the Massachusetts Institute of Technology and has had long experience in machine shops and in drafting rooms, and 1 has had training as a plumber, having been a master plumber for many years and for several years the city inspector of plumbing.

During the school year 1899–1900 the attendance in the various classes averaged as follows: Drafting class, 147; drawing class, 73; tool-making and machine-shop practice class, 32; and plumbing class, 19. The cost of the equipment for the classes in tool making, machine-shop practice, and plumbing was $760, but that for the drafting and

drawing classes can not be separated from the cost of the day drawing classes of the public schools. The annual cost of maintaining these classes is about $1,400, paid by the city.

The school authorities consider that the courses in drafting, drawing, tool making, and machine-shop practice are entirely satisfactory, while the course in plumbing might and will be extended. The drafting and drawing classes have turned out many intelligent young men who are now employed in the industries of the locality. The general intelligence and efficiency of those who have attended these classes have been much increased, and higher wages, steadier employment, and more rapid promotion have accrued to them; they are preferred by employers to merely shop-trained men, and in most trades they can obtain work without undergoing a period of apprenticeship in the shop. Shop training itself in Springfield has been improved as a result of the success of these classes. Labor unions do not seem to have recognized these classes as valuable to workingmen and have given them no aid, nor have they opposed them, as unions, though many union men talk against the classes.

YOUNG MEN'S CHRISTIAN ASSOCIATION SCHOOLS.

It is a well-known fact that the sole object of the Young Men's Christian Associations of North America is the general improvement of young men. Among the various features that are employed toward this end probably none are more productive of practical benefit to the rank and file of the members than the splendid educational system that has been established. During the earlier period of their history the educational work of the associations was largely confined to the study of commercial branches. In the course of time the importance and value of industrial training became more apparent, and one association after another became interested in the subject and added one or more industrial branches to the regular curriculum. For a long time each association had full charge of its own class work, examinations, etc., and there was no particular uniformity in the methods or standards. Having in view the establishment of more definite, unified, and standard courses of study, the international committee of the associations in 1895 made an effort to interest the different associations in a scheme of experimental examinations which would apply to all schools alike and, in a measure, would demonstrate the possibility of establishing a system of standard courses and examinations. It is sufficient to say that the effort was successful from the start. In 1896 the international committee issued its first prospectus containing an outline of the courses of study, and assumed charge of the annual examinations. The system thus introduced has been continued to the present time, and it is said to be a vast improvement

over the methods previously employed. While most of the association schools take advantage of the courses prescribed by the international committee, only about one-third participate in the annual examinations.

The following statement regarding the work of these schools was furnished by the secretary of the educational department of the Young Men's Christian Associations of North America:

A very important part of the all-round work of the associations throughout the continent is that of the educational department. As the associations exist for the welfare of young men in all directions, it is natural that industrial and technical education should occupy an important place in the curriculum of the 350 or more evening schools in the association buildings scattered over the country. The work of these schools embraces the instruction of 26,000 young men by about 1,200 teachers. The subjects pursued are commercial, industrial, scientific, language, political, and miscellaneous, depending largely upon the needs and opportunities of the particular locality.

The following comments concern the work in industrial subjects, in which there are about 6,000 young men engaged as students and 300 as teachers. The industrial work is in operation in about 250 of the 300 cities in which the evening school work of the associations is conducted. This includes all cities of the first and second classes, as there are few associations in cities of 25,000 population or upward that do not have some work classed as industrial. The best work of this character may be found in the following cities: Brooklyn, N. Y.; New York City; Boston and Springfield, Mass.; Chicago, Ill.; Philadelphia, Pa.; Baltimore, Md.; Washington, D. C.; Hartford and Bridgeport, Conn.; Cleveland, Dayton, and Cincinnati, Ohio; St. Louis, Mo.; St. Paul and Minneapolis, Minn.; Portland, Oreg.; Denver, Colo.; Atlanta, Ga.; San Francisco and Los Angeles, Cal.

While the work is industrial to a large degree, part of it may be called trade work, although much of it might be classified as technical, especially so far as it concerns the advanced work in mechanical drawing, machine design, building construction, structural drafting, etc.

The need which led to the establishment of this work of a varied character throughout the country was simply the fact of the readiness of the associations to help young men to help themselves. Thousands of young men already engaged in machine shops and other industrial and manufacturing concerns need help in drawing, whether mechanical, architectural, or design, to enable them to better prosecute their daily work. Furthermore, there are many men in the crowded commercial ranks who are desirous of fitting themselves for industrial positions. These needs and demands the associations are helping to supply as far as their limited means will permit.

As the schools are under the auspices of the local associations in each city, the rules and regulations for entrance, conduct, work, etc., vary slightly, but are not far different from those found in the ordinary evening schools. The courses of instruction are arranged for each subject separately—that is, mechanical drawing, for instance, is a subject by itself, and students pursue that oftentimes without studying anything else.

The regular courses include architectural, free-hand, and mechanical drawing, carpentry, applied mechanics, and machine design. In some

localities the course of instruction includes other branches also. Thus, in Philadelphia there is a course in air-brake construction and manipulation which is specially designed for railway employees. The Boston school has lettering, sign writing, industrial design as applied to furniture, wall papers, printed fabrics, etc., and a two-year course in naval architecture. The Hartford school has forging, plumbing, and jewelry engraving. The general management of each association is in the hands of a board of directors. They employ a general secretary, who is at the head of all forms of association work in a single building. Under the direction of the general secretary are department secretaries, and in a number of the larger cities there is an educational director who gives his entire time to the development of the educational work as a whole. There are 300 instructors. In selecting instructors the training sought is more largely from experience than otherwise, as the students appear to have more respect for the practical, successful manufacturer or artisan than they have for the merely scholastic and theoretical college graduate. There are but two grades, elementary and advanced, for each subject. Sometimes students spend two years in the elementary grade before going to the advanced grade. During the past year there were about 4,500 students in the elementary grades and 1,500 in the advanced grades. As only about one-third of the schools participate in the international examinations, it is difficult to state the exact number of graduates for all the associations. It is estimated, however, that since the introduction of industrial work as a part of the educational system there have been in the neighborhood of 10,000 graduates in the industrial branches. The association property throughout the country is valued at $20,000,000, and a fair estimate of the valuation of the portion devoted to educational work would be one-tenth of that amount, or $2,000,000. Of this latter amount only about one-fifth, or $400,000, could be assumed as devoted to the industrial phases of the work. The cost of maintenance per man per season for all evening class work is from $12 to $15. This is assuming the educational work to share the same proportion of the current expenses as it does in the valuation, or one-tenth, so that including heating and lighting the cost of maintenance would be about $100,000 per annum. The schools are maintained partly by tuition fees and the balance is provided by the local associations.

The courses of training and study, might be improved. The fact that they have been improved by at least 100 per cent during the past six years leads us to feel that there is constant opportunity for further development and improvement. This improvement, however, will probably come from the increased importance of the subjects classified as scientific, such as advanced mathematics, the elements of physics, chemistry, electricity, and mechanics as applied daily to the problems in the various kinds of drawings and shop work. Another form of improvement will come in the increased length of time given to study. Five years ago such time averaged one evening per week per subject. To-day it averages a little more than two evenings per week.

Speaking from the experience of the manufacturing concerns and employers who have employed the young men studying in our schools, the following statement can be made: The educational class work of the associations helps young men to help themselves; it improves the industries by increasing the intelligence and skill of the employees, and it enables the young men to increase their efficiency and receive,

as well as merit, increased remuneration for their services. Each year from 200 to 500 different men are enabled to either secure positions or receive increased salaries because of the knowledge gained in the industrial classes of the associations. For example, one young man three years ago was receiving $40 a month as a bookkeeper. He studied mechanical drawing in our school at Dayton, Ohio, for three years and is now receiving $1,500 a year in the drafting room of the car shops in that city. Ten young men in Brooklyn within the last three years have entered architects' offices where they receive from $2.50 to $5 per day, as a result of their study of architectural drawing in the Brooklyn school.

In two or three places the labor organizations, or sections of the same, have officially indorsed the industrial work of the association schools and also the trade work where it included plumbing and carpentry. In other instances, however, similar work has been opposed by the labor unions on the ground that the schools would fit just so many more men for the trades and thereby "take the bread and butter from the mouths of the members of the union." It can not be said that the graduates of our schools are preferred by employers and superintendents over shop-trained men, but we do know, however, that they are employed on the same basis with the graduates of other technical schools and colleges. One reason for this is that the character of our work is intensely practical. Our teachers are in very many cases the head draftsmen or the superintendents of manufacturing establishments, and we always endeavor to secure the most experienced and successful practical men to handle the work in the industrial subjects.

We have no evidence that our work has led to the improvement of ordinary shop training. However, good work in any line, no matter how small, has a conscious or unconscious influence toward improvement. These schools, in a general way, have proved satisfactory. They have not as yet attained the end for which they were established, but the results have been increasingly encouraging, especially during the past five years. Our system of rigid examinations throughout the continent has been of great value in raising the standard of work during this time, so much so that many colleges and technical institutions are in sympathetic and cordial cooperation with us in this movement, and officially recognize our international certificates at their face value as based upon our prospectus.

The work of the Boston and Hartford schools being representative of the most complete courses in the industrial branches, these schools are treated in detail.

YOUNG MEN'S CHRISTIAN ASSOCIATION, BOSTON, MASS.

This school was established in 1896 to provide for the educational needs of those who have been deprived of a good foundational education. The school aims to educate the student in just as broad a sense as his ability will permit, and every course is framed and conducted on an educational basis, with strictly practical ends in view. The object of the school is to furnish the best equivalent for a regular day-school course in whatever department the student may elect. Perfect

freedom is allowed in the matter of studies selected, provided those are taken which are adapted to the abilities of the student. There are ten departments, or courses, of instruction, as follows:

1. Elementary: Arithmetic, grammar, spelling, geography, writing, reading.
2. Civil service: Arithmetic, grammar, geography, railroad junctions, reading, writing, spelling, copying rough draft, copying from dictation, reading addresses, special lines in drawing—mechanical and architectural.
3. Commerce: Arithmetic, bookkeeping, penmanship, shorthand, typewriting, commercial law, commercial English, German, French, Spanish, and commercial geography.
4. High school: Arithmetic, algebra, geometry, Latin, French, German, and Greek.
5. Drafting: Mechanical, architectural, mechanical design, ship drafting, sign writing, French, German, algebra, geometry, and lettering.
6. Languages: English, French, German, Latin, Spanish, Greek, and Italian.
7. Music: Piano, voice, organ, violin, harmony, composition, cornet, flute, mandolin, guitar, and banjo.
8. Law: Contracts, torts, criminal law, agency, property, equity, bills and notes, practice and pleading, partnership, evidence, corporations, wills, constitutional law, recitations, quizzes, and moot courts.
9. Art: Free-hand drawing and industrial design.
10. General: Elocution, literary society, young men's congress, government, clubs, class organizations, concerts, lectures, musicales, etc.

Separate courses may be taken by those who desire it, but the school authorities recommend that the student enter one of the ten departments requiring from two to four years of study and take all the work prescribed therein.

In 1899 the whole number of students in the various departments of the institute was 812, all males. The number of classes was 45, the membership of all classes was 1,790, and the total number who had attended the school since its opening was 31,623.

Only the drafting and art departments come within the scope of this report as clearly industrial in character, and their courses are as follows:

The departments of drafting and art afford instruction in elementary drawing, mechanical and architectural drawing, mechanical design, naval architecture, lettering, free-hand drawing, industrial design, and sign writing.

The aim of the entire work is to turn out finished draftsmen in all lines, and with that end in view the best teachers are employed from the leading schools, and every feature is conducted on a professional basis.

The elementary drawing class offers a course in the principles underlying all mechanical and architectural drawing. This class is a feeder for the advanced classes into which students will be promoted at any time they are prepared. Geometrical problems, shadows, intersections, projections, and all the elementary principles will be fully presented in a clear and practical manner.

In mechanical drawing the course comprises instruction in machine drawing, sketching from the machine, the construction of scale drawings and tracings, and the preparation and use of blue-print paper. The object of this course is the production of finished detail and assembly drawings for shop use. A practical knowledge of projections and shading, as well as some proficiency in the use of drawing instruments, is most essential, these subjects being given in the elementary class.

The object of the course in mechanical design is to provide practical instruction upon a number of subjects relating to engineering work. Hitherto draftsmen, machinists, and others desiring to study special mechanical problems have applied for admission to the class in advanced mechanical drawing. A special class is now provided for such students. To enter this class the student must be somewhat familiar with mechanical drawings. He must also be possessed of a good knowledge of arithmetic. The course consists of twenty-four lectures upon the subjects scheduled, many of the problems being demonstrated by apparatus, dummy engine gears, etc.: (1) Strength of materials; (2) standard bolts; (3) levers; (4) screws and toggle joints; (5) cams; (6) belts; (7) ropes; (8) pulleys and shafting; (9) and (10) gears; (11) and (12) riveted joints; (13) to (16) boilers; (17) and (18) steam engines; (19) and (20) steam-engine indicators; (21) and (22) iron and steel manufacture; (23) and (24) mill structure. Each student is required to keep a thorough notebook, and work out numerous problems in connection with the above topics. The class meets on Wednesday evenings at 7.45.

The three-years' course in architectural drawing aims to acquaint the student with the scientific principles underlying the study of construction, and with the elements of mathematics and mechanics necessary to the solution of architectural problems. Owing to the limited amount of time possible in evening work, some subjects are omitted which serve only to broaden the education. The purely architectural subjects, however, are retained and the student given the essentials.

The first year's work consists of the proper use of instruments, geometrical problems, intersections, shadows, and lettering. Free-hand drawing from the cast and model should be taken during the entire three years. One foreign language is also offered during the same time. The strictly professional work begins in the second year with instruction in the classic moldings, five orders, timber, brick, and stone construction, pen and ink rendering, architectural history, and elements of design. The third year the student is thoroughly drilled in original design; instruction is also given in shade and shadow rendering in india ink, perspective, business law, heating and ventilation, and steel, stone, and brick construction.

Applicants for admission to the second or third year classes, omitting the previous grades, must show that they possess the requisite knowledge.

Students are received as members of any class for which they are qualified, but the necessity of taking the complete course is urged. Students entering with a view of making architecture a profession have programmes arranged by the educational director.

The revival in the shipbuilding interest of the United States is calling into activity a class of draftsmen who for years have been in slight demand. Ship draftsmen have been so little called for during the past fifteen years that few have fitted themselves for this particular field, and now that they are in demand the supply is inadequate. With the wish to place this much desired instruction in the reach of draftsmen, students, and yachtsmen, the following courses have been framed. Yachtsmen will find the work helpful and suggestive and an effort will be made to frame courses adapted to their special needs.

First year.—Drafting: Lines—sheer plan, half-breadth plan, body plan, midship section; projections—water lines, cross sections, diagonals, section lines. Construction (steel or wood): Keel, keelson, frames, floors, deck beams, planking or plating, decks, ceiling, riveting or fastening.

Second year.—Calculations: Displacement, center of buoyancy, areas of cross sections, areas of water lines, areas of lateral plane, areas of midship section, displacement per inch, center of lateral plane. Yacht construction: Keel, keelson, frames, floors, beams, clamps, decks, planking, fastening. Lead keels: Calculation of weight; calculation of center of gravity. Sail plans: Calculation of area, calculation of center of lateral resistance, calculation of balance.

The instruction in mechanical lettering, which is of the utmost importance to all engaged in any line of drawing, covers two hours per week. No matter how well made a drawing may be, poor lettering will ruin its appearance, so that the student who expects to become a really valuable man, and one commanding a good salary, must become expert, not only in drafting, but in lettering also. Many able draftsmen are unable to secure desirable positions because of their inability to letter well.

The course in free-hand drawing includes drawing from the object, forms, plaster casts, and life; instruction in the use of pencil, charcoal, and brush; perspective; elements of design, and technical application. To young men engaged in such pursuits as architecture, lithography, designing, and engraving, where judgment of the eye and training of the hand are needed, this class is especially helpful. A new and well-lighted room has been provided, furnishing excellent facilities.

A course in practical design as employed in the arts and crafts, including such subjects as stained glass, furniture and drapery, wall papers, printed fabrics, book covers and inlaid work, the study of form as applied to pottery and its decoration, wrought and bent ironwork, wood and stone carving, and interior decoration. The term is divided into two sections. The first, from October to December, is devoted to the study of the various styles of historical ornament, animal and plant forms, and the principles of construction in design. The second term, from January to April, is devoted to the practical application of design, the technicalities of the various arts and crafts, the final rendering of design in charcoal, pencil, pen and ink, and water colors. The instructor is a certificated art master and one of the leaders of the profession. Every effort is made to have this course of practical value to men from the various trades.

The course in sign writing offers complete instruction, including the preparation of new and cleaning of old boards; the mixing of paints and sizings for all purposes; bronze, gold, and silver lettering; gold and silver lettering on glass, worked up in numerous ways, being placed on the back of the glass, thereby producing beautiful effects; lettering on card and cloth (one of the great commercial branches); gold and black lettering on office doors; treating with gold, silver, and aluminum on any surface; lettering on banners (silk or cotton); sign advertising on walls and fences in all its branches; engraving on brass and princess metal; fancy lettering of every description—monograms, scrolls, and striping.

The total number of instructors in the institute in 1899 was 39, of whom 7 devoted all, or part of, their time to instruction in the department of drafting and art, and 1 of these is a certificated art master; 3 are instructors in the Massachusetts Institute of Technology, 2 are expert sign writers, and 1 is a practicing architect. Five of the above were professionally trained in colleges. During this year there were 193 students in this department, and about 80 have taken full courses therein since the department was opened.

Members of the evening institute are required to hold a $5 association membership ticket or a $10 gymnasium ticket, and in addition, to pay, in either case, the small class fee for each subject.

The educational ticket also entitles a member to the privileges of the evening institute, library, reading room, reception room, socials, bathing facilities, free storage for bicycles during the riding season, summer camp, and free admission for self and lady to the Association Star Course of Entertainments.

As an aid to worthy men who desire an education, and are unable to pay in full even the slight charges, a limited number of scholarships

has been provided. Early application is necessary, as the funds available for this purpose are limited. It is necessary for each applicant for a scholarship to furnish satisfactory references.

The following annual class fees are exacted: Architecture—elementary, $2, advanced, $4; free-hand drawing, $1; industrial design, $2; lettering (mechanical), $2; mechanical drawing—elementary, $1, advanced, $2; mechanical design, $4; ship drafting, $5.

The management of the institute is in the hands of the educational director under the control of the education committee of the Boston Young Men's Christian Association.

The cost of the equipment for this department was about $2,000, and the annual cost of maintaining it is about the same amount. The funds for maintaining, etc., are procured, one-third from tuition fees, one-third from the endowment fund, and one-third from subscriptions of the members of the association.

It is thought by its friends that the department might be improved by adding mechanical engineering and bridge construction to the courses provided, but the existing courses are about as good as it is possible to have them. The establishment of the department has, it is said, increased the intelligence of the workmen of the locality, bettered their character, extended their horizon, given them a greater appreciation of the advantages of extended education, and raised their efficiency. As a result of this higher wages, steadier employment, and more rapid promotion have followed in many cases, and those who have taken the course are preferred by employers, etc., to merely shop-trained men because, knowing, as such men do, why they perform certain operations as well as how to do them, they are better equipped for their work. The shop training in the locality has been improved, as the shops are trying to follow the pace set by the institute in industrial training. A large number of men engaged at their trades during the day have attended the classes, doing very creditable work, and expressing great appreciation.

Moral aid alone has been given the school by the labor unions, but they have manifested no opposition to it. The institute has been successful so far in all its departments, and has fully attained the end for which it was established.

HILLYER INSTITUTE (Y. M. C. A.), HARTFORD, CONN.

Six-sevenths of the boys who become mechanics in this locality leave school at 14 years of age, with only a rudimentary education. While they may acquire much practical knowledge by their work, yet under modern conditions they can have little opportunity to become thoroughly equipped mechanics by work in the machine shops and mills, and therefore few rise beyond a certain point of attainment in their trades. They may, under the shop system of education, become

the master of some one machine or some one operation, but can never learn in the shops all the details of their trades so as to become fitted for the positions of foremen, overseers, or superintendents. Their only chance to fit themselves for such positions is by study outside of working hours, and the night school offers them the best opportunity for this.

Recognizing the need of special technical education, and also the need of an education in general lines beyond that which the average workman is able to obtain in the day schools, the Hartford Young Men's Christian Association has conducted educational classes for many years. It was, however, unable for a long time to develop to any great extent this very important part of its work. Its present good condition and its opportunity for growth were made possible by the erection of a new building and the special provision made for the educational department now known as the Hillyer Institute. On December 22, 1892, Mr. Appleton R. Hillyer and Miss Clara E. Hillyer presented the association with an endowment fund of $50,000, the income from which is used for this work. The gift was made in memory of their deceased father, Gen. Charles T. Hillyer, and its object, to quote from the terms of the gift, was "to promote manual, industrial, commercial, and art education in art, more especially the useful arts—and to inculcate habits of industry and thrift."

Because of this fund the association has been able to teach a variety of subjects and to add to its curriculum the industrial classes so greatly needed in a city like Hartford, where many young men are engaged in mechanical pursuits.

The school is under the management of an educational secretary, who acts under the direction and with the cooperation of the educational department committee of the association. Courses of instruction are provided in architectural, free-hand, and mechanical drawing, carpentry and cabinetwork, engraving, forging, plumbing, and electricity.

The outlined courses of the various industrial branches are as follows:

Architectural drawing.—Elementary principles of projections: Directions for use of instruments and material, application to simple geometrical forms, explanation of geometrical terms and method of finding plans and elevation of simple figures. Method of laying out roofs with steel square (showing application to all forms of roofs), plans and elevation of a small dwelling house. Isometrical drawing: Principles and theory with application to simple geometrical figures. Elementary details: Window frames, door frames, cornice details for frame dwellings, instruction in tracing and blue printing. Principles of projections: Development of covering of cylinder and cones and application to sheet-metal work, development of covering of domes and spheres, lines of intersection of cylinders, cones, spheres, etc. Details: Window frames for brick and stone buildings, floor and roof framing, details for chimneys, fireplaces, and stair cases, complete set of working drawings for frame dwelling to cost about $5,000. Details of stone and brick work, ironwork, roof trusses, complete set of working drawings for stone and brick schoolhouse. Perspective: Definitions and principles, method of finding perspective of simple geometrical

figures, perspective of frame dwelling from working drawings made in previous lessons, introducing also some practice in free-hand drawing.

Free-hand drawing.—The use of various materials, how to look at a model, use of antique casts, application to other lines of drawing, measurement by the perpendicular, the horizontal, and the diagonal, size of drawing, character of outline, relative strength of lines, variations of same, artistic feeling in a line, forms, modeling with stump, use of the charcoal, of crayon, adaptability of the latter, light, shadow, half tones, relations of one to the other, importance of accuracy, how to look for values, taken as a whole, separately, atmosphere effect of drawing, sketching in pencil, use of same, relation of pencil to charcoal or crayon the same to painting, brushes, brush treatment, comparison with pen-work results, all forms of vehicles in their proper place, application of pictures to the mind of observer, relation of the arts, the broadness of the painter's field as compared with music, literature, sculpture.

Mechanical drawing, elementary.—Geometric problems, illustration of the planes of projection: Horizontal, vertical, plan, elevation, point, line, solids. Sections, crosshatching, shade lines, direction in which light is supposed to fall. Projection of objects on the inclined plane: Solid cube, flight of steps, projection of circle making an angle with the plane of projection, ellipse, mode of describing, cone pulley, hexagonal nut, conic sections.

Mechanical drawing, advanced.—Intersections: Solids, cylinders, cones, spheres. Connecting-rod end, screws, gearing: Cycloid curve, epicycloid, hypocycloid, involute, laying out gear teeth, worm, spur, and bevel gears eccentric. Development of cams: Continuous-motion cams, irregular cam and roll, cylindrical cam. Tracings, blueprint solution, and preparation of paper. Belts (showing relation to pulleys): Straight belt, quarter-turn cross belt, machine details. After finishing this course students may take up machine design and practical trigonometry.

Carpentry and cabinetwork.—Framing: Sills, floor timbers, studs, roofs, etc. In cabinetwork the students may make such articles as bookshelf, table, panel and panel box, book case, mantel shelf, mantel and overmantel, music rack, easel, silver chest, portable writing desk, panel desk, china cabinet, writing desk with pigeonholes and drawers, tool chest, etc., finishing and varnishing.

Forging.—Drawing to a taper, drawing out flat, drawing and bending, bending, drawing, bending and twisting, upsetting and forming, drawn bolt, upsetting and bolt making, punching and making square and hexagonal nuts, corner iron, bending and shouldering, upsetting, splitting and drawing, fish spear, punching, slotting, and forming, lathe dog, bending, scarfing and welding, welded collar, chain ring, chain weld, guy-rod joint, punching, drawing and forming, butt weld, scarf welding, pair of tongs, carriage wrench, drawing and tempering, prick punch, small cape chisel, reamer, drawknife, right-hand side tool, diamond point and other tools, scratch awl, hot cutting chisel, hammer, butcher's cleaver, welding steel on iron, ice tongs, springs.

Plumbing.—Manual instruction, lead seams, overcast joints, cup joints, calking. Wiping the following: Horizontal round joint, horizontal branch joint, upright round joint, upright branch joint, stop cock, 2-inch ferrule, bath plug, vertical branch, side flange, floor flange, 4-inch ferrule, traps, tank seams, setting basins, sand bends, etc. Scientific instruction: Drain, soil, and waste pipes, trapping and ventilation of drain, supply pipes, boilers, tanks, fixtures, trapping and ventilation of fixtures, pumps, etc.

Electricity.—Frictional electricity: Attraction and repulsion, conduction and distribution, electrophorus, frictional and influence machines, electroscope, leyden jar. Magnetism: Properties of magnets, methods of making magnets, distribution of magnetism, terrestrial magnetism. Current electricity, simple voltaic cell, chemical action in the cell, Le Clanche cell, physical and physiological effects of the current, currents produced by induction, induction coil, atmospheric electricity, electromagnets, electric bells, electro-dynamics, Ohms law and its consequences. Electrical measurements: Galvanometers, electrometers, electrostatic volt meter, electro-

dynamo meter, condenser, Wheatstone's bridge, watt meter, ampere meter, volt meter. Thermo-electric currents, heating effects of currents, electric lighting, arc light, incandescent light, magneto-electric generators, dynamo electric generators, direct-current motors, alternating-current motors, alternating-current generators, self-induction, transformers, electrolysis, accumulators, electro-deposition, cable telegraph, telephone.

Engraving (jewelry).—Analysis of letters, nature of the different metals to be engraved, mode of sharpening tools to get different effects from one tool, rules to be observed in laying out inscriptions, designing monograms, cutting copper plates, cutting steel dies, lectures on the processes employed in half-tone and steel engravings.

The course in architectural drawing requires about two winters to complete. This is an excellent class for carpenters, plumbers, masons, and others having to do with the construction of buildings where the reading of drawings is required.

The course in mechanical drawing is of great value to the young machinist who aspires to enter the drafting room when his time is served. It is an excellent course for any machinist, as it will teach him not only to read the drawings of others, but also to make them for himself. To become a skilled mechanic it is necessary to be able to read drawings. Young men in other occupations have taken this course, and as a result have secured more congenial employment.

The course in carpentry embraces a variety of bench work, and brings into use the tools commonly used in the trade. As the instruction is individual, great freedom is allowed in the choice of work. Young men who wish to make useful and ornamental pieces of household furniture, but have no convenient place or good tools at home, find the class room of the school pleasant, attractive, and well equipped, with a good instructor present. The student pays for the material used if he takes the finished work home. This class, which is in charge of an experienced builder, is of very practical value to apprentices in the trade.

The course in forging is very practical, embracing exercises in drawing, bending, welding, upsetting, tempering, etc. After the student has finished a comprehensive course of iron, he begins to work in steel, making tools such as diamond point, side tool, chisel, hammer, etc. All work is done from blue prints, thus teaching the student to read drawings. From time to time the instructor gives talks and demonstrations of principles not included in the course. One season a plumber, after completing the preliminary work, made for himself a set of plumbing tools. Anything made in this class may be taken by the students by paying for the material. Young men who desire to become blacksmiths are well paid for the time spent in this class. Machinists, who have to forge and temper the tools they use, find this course adapted to their needs. Young men in drafting rooms who are making drawings for articles to be made in iron or steel become familiar with the nature of these metals by handling and working them here.

In the course in plumbing the instruction is both manual and scientific. The manual instruction consists of making solder, wiping joints, sand bends, making traps, etc. The scientific instruction is given upon the proper arrangement of service and waste pipes and upon drainage and ventilation. In this kind of work he is greatly aided by a large number of colored diagrams. This is a class that is of special benefit to apprentices who have to pass examinations before entering the trade, and to all others interested in the trade. There are young men who are undecided as to what trade they will learn, fearing that they will not select the right one. These, if they ever thought of becoming plumbers, may enter this class for a season and perhaps be helped to choose a congenial vocation. Linemen, who are frequently called upon to wipe a joint where wires are connected, may also take this course with profit.

The object of the course in electricity is to give the student a working knowledge of the subject. Both the student seeking general information and the young man who expects to earn a living in some electrical business will be benefited by a systematic study of the subject.

The expenses of a course of instruction in any of the industrial courses is, first, an annual fee of $2 for membership in the association and an additional entrance fee of $1 for new members; second, a class fee of $3 per term of 20 lessons. If more than one study is taken, there will be a reduction in this class fee of $1 on each additional study. In the class of jewelry engraving, instead of having two terms of 20 lessons each, enrollment must be made for the entire 40 lessons, and the fee will be $6 for the course.

Any young man 16 years of age or over, of good character, without regard to color, nationality, or religious belief, may enter these classes by becoming a member of the association. Boys from 11 to 17 years of age may enter certain classes by becoming junior members of the association at a cost of but $1 for a year. When a young man has completed any of the graded courses, he is entitled to a departmental award upon passing the required examination. This examination may be written, oral, or shop work, as the subject may require. Certificates of attendance will be given to all students who have been present at 75 per cent of the class sessions. The member of each class having the highest per cent of attendance and showing the greatest improvement in his work will be given an advanced course in the same study, or may take any other subject, free of charge for one season, including his regular membership in the association.

There are 11 instructors in the industrial branches of this school, all of practical experience in the trades taught.

During the school year 1899–1900 there were 13 students in the course in architectural drawing, 76 in the course in mechanical drawing, 14 in the course in free-hand drawing, 12 in the course in carpen-

try and cabinetmaking, 10 in the course in forging, 10 in the course in plumbing, 19 in the course in electricity, and none in the course in jewelry engraving, which is a course just established.

The majority of those who take instruction in these classes do not complete the full course of instruction as laid out. Only those who complete the courses are considered graduates, and up to and including the school year 1899–1900 they were as follows: Architectural drawing, 1; mechanical drawing, 18; forging, 12.

These classes are held in the regular building of the Young Men's Christian Association.

The cost of equipment, etc., has been about $2,500, and the cost of maintenance for the year 1899–1900 was about $2,372. The funds to pay these expenses come from interest on the endowment fund, from fees, and from tuitions.

The officials of the school believe that the courses in the industrial branches could be improved by making more effort to adapt the work to the needs of mechanics, by holding the classes at least three nights a week instead of two, as at present, and by increasing the length of the courses. The outlook for such improvement is said to be good. Every possible improvement is being made as fast as funds available will allow.

This school by its courses of instruction is increasing the efficiency and general intelligence of the workmen. Those who have been instructed here have attained greater skill and a higher earning capacity, which has led to higher wages, steadier employment, and more rapid promotion. Their generally higher intelligence and skill has made them preferred by employers to merely shop-trained men. While no formal system of apprenticeship prevails at present, yet as a general rule a boy must spend a period of some years as a learner in all industries before being considered a full mechanic or being paid as such. The graduates of this school start work as full mechanics on full pay.

In a general way this and other schools of the same character have proved satisfactory, and if we consider the end for which they were established to have been the improvement of the working classes in intelligence and skill, they have fully attained it. They are all susceptible of improvement and always will be.

INSTRUCTION BY CORRESPONDENCE.

While instruction by the correspondence method is of comparatively recent origin, it has, nevertheless, grown to such considerable proportions, more especially within the last few years, that its importance and value as an educational factor have now come to be recognized even by many who heretofore have been wont to look upon it as an

absurd innovation in the field of education. Notwithstanding the practical results that have already been accomplished by these schools, and which are freely admitted by both employers and workmen, some doubt still exists in certain quarters regarding the possibility of giving adequate technical instruction by the correspondence method. When the environment of the class of students to which these schools appeal and the system of teaching that is employed are considered, however, the claim that instruction by this method is not susceptible of practical results is very largely disproved. Correspondence schools appeal particularly and with considerable force to mechanics and apprentices who are already engaged in occupations and trades which require more or less of a theoretical and technical knowledge that can not be acquired in the ordinary routine of daily work. It is generally conceded that the theory and technique of most trades are beyond the reach of the ordinary workmen unless they devote a portion of their time to study. In the vast majority of cases they leave school for the workshop with hardly more than the bare rudiments of a common school education, and the need of theoretical and technical instruction in the trades rarely occurs to them until they are brought face to face with the fact that future advancement depends almost entirely upon the acquisition of this knowledge. This being the case, if they are to acquire this knowledge at all they must obtain it by attending some evening school where the trades are taught according to approved methods, or they must resort to the aid of special text-books and master them as best they can. While the night schools afford a remedy for those who reside in their immediate vicinity, still there are thousands of workers in the smaller cities and towns and the rural districts generally who are debarred from this privilege. Consequently, if the circumstance of locality or time be such that they can not attend a night school, their only alternative is to adopt the text-book method. It is this class particularly that the correspondence schools aim to reach.

This, however, is not the only class that seeks the aid of these schools. There are hundreds of men engaged in the higher branches of technical and scientific work to whom the system of instruction papers and text-books designed and controlled by these schools have strongly appealed. Of this class may be mentioned the architectural draftsman who has acquired a practical knowledge of plan and detail drawing and desires to obtain a modern knowledge of building design and construction. So, too, the mechanical draftsman who desires to supplement his drafting-room experience with a complete mechanical course and thereby qualify as a machine designer or mechanical engineer. Then there is the engineer who desires a working acquaintance with other branches of engineering closely related to his own, and also the student fresh from college, well equipped with a general education,

who wishes to take a special course in some particular branch. For these classes, as well as many others, the correspondence schools are particularly well adapted. The increasing number of trained mechanics and students of liberal education who are taking special courses in these schools is a fair indication that the system of instruction by mail is of more than ordinary importance. Indeed, there is such abundant evidence of the appreciation of the work of these schools that there is every reason for including them in this report.

There are a number of these schools in different parts of the country, among which may be mentioned the International Correspondence Schools, Scranton, Pa., American School of Correspondence, Boston, Mass., and Electrical Engineer Institute of Correspondence Instruction, New York.

The character of the courses and the methods of instruction employed in the schools are substantially the same.

The object, methods, and work of these schools are well represented in a statement which was furnished by the officials of the Scranton school, and is in part as follows:

The distinctive function of these schools is to teach the theory of engineering and the trades to men and women already at work.

The success of the method of teaching by mail depends very largely on the subdivision of the student's work into many short, easily mastered lessons, or parts. These are sent to him in a fixed, invariable order in the shape of instruction and question papers, drawing plates, and whatever else his course may contain. The instruction papers are printed in pamphlet form of from 10 to 100 pages. Each paper is complete in itself and contains all the instruction required for the mastery of the next paper, but includes nothing that is not necessary for a complete understanding of it. The writers assume that the student knows nothing more about the subject in hand than has been treated in a previous paper. Only the plainest language is employed, and many facts, principles, and processes that would otherwise be hard to understand are made clear by the use of zinc etchings and half-tone illustrations.

As soon as the student is enrolled, his first and second instruction and question papers are sent to him, accompanied by directions for proceeding with the work, inquiry blanks, and a supply of envelopes.

After carefully reading the directions, he studies the first instruction paper and works out the examples for practice. If he meets with any difficulty, he fills out an inquiry blank, giving full particulars, sends it to the school, and proceeds with his studies. A full written explanation of the matter is promptly forwarded from the school, and he is encouraged to write for special information at any time. After mastering the contents of the first instruction paper, he takes up the

accompanying question paper and writes his answers to the test questions. He then forwards these answers to the school and proceeds to study the second instruction paper.

When the sets of answers are received at the school, they are reviewed by examiners specially trained for this work. The papers are carefully gone over, such errors as exist in arithmetic, spelling, punctuation, etc., being checked in red ink. When an error is discovered, it is not only indicated in red ink, but a careful explanation of that particular problem is written on the back of the sheet. Whenever necessary, special exercises and letters of explanation are sent to the student.

After being corrected, the papers are entered upon the books as passed if a satisfactory mark has been attained. If his mark is not satisfactory, the student is required to review the incorrect portions until mastered. The answers are then returned, accompanied by a percentage slip and the third set of papers. By this system the student always has one paper to study while his work on a previous paper is being corrected.

The instruction paper on drawing and a mailing tube for returning the finished plate are sent with the first arithmetic paper. Detailed directions are given for the use of instruments, making the first plate, and sending in the work. Beginning with the drawing of simple lines, the student is gradually advanced to actual working plans of mechanical and architectural constructions. The model plates are smaller than the required plate. He thus makes an original drawing, according to scale.

If the student meets with continued difficulty in the study of any subject, a special instructor is, on request, assigned to him (without extra charge), who gives personal attention to his case until the subject is completed.

Nearly all of the students are compelled to study under the greatest disadvantages. Although in the Scranton school their average age is about 26 years, more than 80 per cent know nothing of fractions when they begin their studies. For such students as these the ordinary text-book is intricate and difficult. It presupposes the help of a living present teacher, and without such help its difficulties are insurmountable, and the attempt to use it in this method of self-help results in speedily convincing the student that education is unattainable without the aid of a teacher. It was obvious at the outset that text-books for teaching the manual industries by mail must combine simplicity with thoroughness, otherwise failure was inevitable. But no such text-books were in the market. It was necessary to have them written. For this work men strong both in the theory and practice of each trade to be taught were found. In engaging men to prepare the text-books for any industrial or engineering specialty, the management of the school states that two conditions of fitness have been rigidly insisted

on: First, that they must have thorough theoretical education in that and allied specialties; and, second, that their education in theory shall have been supplemented by satisfactory practical training. Both the technical school and the workshop must be represented in their equipment.

The courses of study are arranged with a view to meeting the requirements of all classes of workers in mechanical industries, from the humblest apprentice to the skilled mechanic and the trained engineer. The courses for the former class provide for a thorough training in the theory and principles of the particular subject or occupation, while those for skilled mechanics and engineers include also special and advanced instruction in the higher branches.

In addition to the courses in the mechanical industries, the railway department affords both theoretical and practical instruction in the construction and operation of locomotive engines, air-brakes, etc., to locomotive engineers and firemen and to brakemen and train hands.

The list of the courses of instruction is as follows: Complete mechanical, refrigeration, gas engines, farm machinery, shop practice, stationary engineers', marine engineers', locomotive running, mechanical-locomotive, trainmen's, air-brake, electrical engineering, electrical, electric power and lighting, electric lighting, electric railways, electric-car running, wiring and bell work, telephony, telegraphy, mechanical drawing, architectural drawing, complete architectural, architectural drawing and design, building contractors', ornamental design, sheet-metal pattern drafting, sanitary plumbing, heating, and ventilation, heating and ventilation, sanitary plumbing and gas fitting, gas fitting, sanitary plumbing, lettering and sign painting, complete coal-mining, full mining, metal mining, metal prospectors', civil engineering, bridge engineering, railroad engineering, hydraulic engineering, and municipal engineering. Owing to the extended list of separate and distinct courses which are taught, no attempt is made toward a detailed description of the same. In order, however, that a better idea may be had regarding the scope of the work, a synopsis of a number of the courses is given:

Complete mechanical course: This is intended for machinists, draftsmen, pattern makers, tool makers, designers, mechanical engineers, and all others who are engaged in mechanical work. The subjects taught are arithmetic, formulas, geometrical drawing, mechanical drawing, geometry and trigonometry, elementary mechanics, hydromechanics, algebra, logarithms, pneumatics, heat, steam and steam engines, strength of materials, applied mechanics, steam boilers, machine design, and dynamos and motors.

Shop-practice course: This course is divided into five parts, as follows: The machine-shop division is intended for all those who wish to get a thorough knowledge of modern machine-shop practice. The tool-making division is intended for those who desire information in regard to the latest and most approved methods used in the making of tools. The pattern-making division covers thoroughly the subject of pattern making in all its branches. The foundry-work division gives thorough instruction in all phases of foundry work. The blacksmithing and forging division

is intended to give blacksmiths, helpers, and all employed in smith shops and forges a thorough knowledge of the best methods employed in their trade. The subjects taught are reading working drawings; arithmetic; measuring instruments; lathe work; working chilled iron; planer, shaper, and slotter work; drilling and boring; milling-machine work; gear cutting; grinding; bench, vice, and floor work; general hints on shop practice; tool making; pattern making; foundry work; blacksmithing and forging.

Mechanical-locomotive course: This course provides instruction in theoretical and applied mechanics, steam engines and boilers, mechanical drawing, machine design, and the principles of construction and operation of locomotives and dynamos and motors. It is intended for master mechanics, roundhouse and machine shop foremen, machinists and draftsmen in railway machine shops, and enginemen who desire to qualify for positions in the mechanical departments of railways. The subjects taught are arithmetic; formulas; geometrical drawing; mechanical drawing; geometry and trigonometry; elementary mechanics; hydromechanics; algebra; logarithms; pneumatics; heat; steam and steam engines; strength of materials; applied mechanics; steam boilers; machine design; dynamos and motors; locomotive boilers; steam, cylinders, and valve gears; locomotive management, including breakdowns; compound locomotives; the Westinghouse air-brake; the New York air-brake; train rules; car heating; car lighting; the electric headlight.

Complete architectural course: This is intended for architects, draftsmen, contractors and builders, carpenters, masons, bricklayers, building tradesmen, and all others desirous of qualifying themselves to design and construct buildings. The subjects taught are arithmetic, formulas, geometry and mensuration, geometrical drawing, architectural drawing, ornamental drawing, advanced architectural drawing, masonry, carpentry, joinery, stair building, ornamental ironwork, roofing, sheet-metal work, electric-light wiring and bell work, plumbing and gas fitting, heating and ventilation, painting and decorating, estimating and calculating quantities, history of architecture, architectural design, specifications, building superintendence, contracts and permits, architectural engineering.

Sanitary plumbing, heating, and ventilation course: This course affords an education in plumbing, heating, and ventilation that will qualify any plumber, steam fitter, or gas fitter to fill the highest positions in his line of work. The subjects taught are arithmetic, geometrical drawing, mechanical drawing, mensuration, mechanics, plumbing and drainage, gas and gas fitting, electric-light wiring and bell work, principles of heating and ventilation, steam heating, hot-water heating, furnace heating, ventilation of buildings.

Complete coal-mining course: This is intended for mining engineers, miners, and mine officials who wish a complete education in the methods and machinery used in coal mining. It embraces a study of every detail necessary to fit a student for any position in anthracite or bituminous mines, or to pass the examinations for mine foreman or State mine inspector. The subjects taught are arithmetic; formulas; geometrical drawing; geometry and trigonometry; gases met with in mines; mine ventilation; mine surveying and mapping; economic geology of coal; prospecting for coal and location of openings; shafts, slopes, and drifts; methods of working coal mines; mechanics; steam and steam boilers; steam engines; air and air compression; hydromechanics and pumping; mine haulage; hoisting and hoisting appliances; surface arrangements of bituminous mines, surface arrangements of anthracite mines; compressed-air coal-cutting machinery; percussive and rotary boring; dynamos and motors; electric hoisting and haulage; electric pumping, signaling, and lighting; electric coal-cutting machinery.

Full mining course: This is intended for mine superintendents, foremen, mining engineers, and others who wish a thorough education in all branches of mining. The subjects taught are arithmetic; formulas; geometrical drawing; geometry and trigonometry; gases met with in mines; mine ventilation; mine surveying and mapping,

economic geology of coal; prospecting for coal and location of openings; shafts, slopes, and drifts; methods of working coal mines; mechanics; steam and steam boilers; steam engines; air and air compression; hydromechanics and pumping; mine haulage; hoisting and hoisting appliances; surface arrangements of bituminous mines; surface arrangements of anthracite mines; compressed-air coal-cutting machinery; percussive and rotary boring; dynamos and motors; electric hoisting and haulage; electric pumping, signaling, and lighting; electric coal-cutting machinery; blowpiping; mineralogy; assaying; geology; prospecting; placer and hydraulic mining; preliminary operations at metal mines; metal mining; surface arrangements at metal mines; ore dressing and milling.

Railroad engineering course: This is intended for railroad employees, track inspectors, section men, assistant engineers, railroad surveyors, and all others engaged in the survey, construction, or maintenance of railroads. The subjects taught are arithmetic, formulas, geometrical drawing, mechanical drawing, geometry and trigonometry, elementary mechanics, hydromechanics, algebra, logarithms, pneumatics, strength of materials, surveying, land surveying, mapping, railroad location, railroad construction, track work, railroad structures.

In the departments that deal with engineering and industrial technics there are, including principals, 42 male instructors and 191 female assistant instructors. These numbers represent about 80 per cent of the entire instruction force of the school. In addition to having experience in practical work, more than two-thirds of the faculty are also graduates of colleges and technical schools. With respect to the training of subordinate instructors, it should be stated that they are graduates of high and normal schools, and a considerable number of them are graduates of colleges. Before obtaining full recognition as members of the corps of instructors they are required to pass an examination both oral and written, and, in most cases, to serve during a specified period of probation.

Unlike the ordinary resident schools, there are no established grades or classes. The number of students graduated in a given time from an ordinary technical school or college furnishes a pretty reliable measure of its success. With this institution the case is otherwise, as may be gathered from the following facts:

First. A large number of persons enroll and pay tuition for the sole purpose of obtaining text-books for use in their business. This class has no intention of studying systematically and no wish to obtain diplomas.

Second. While there is an enrollment of more than 300,000, only 5 per cent have been connected with the institution more than four and a half years, and experience has shown that students do not complete the more important courses in less than five or six years. Haste it is claimed is neither necessary nor desirable, for students are earning and learning at the same time, and the longer time gives all the greater opportunity to exemplify theory in practice.

Graduation, therefore, which, in the case of students in ordinary institutions, is an event of crowning importance, marking as it does the end of school life and the beginning of the student's period of pro-

ductive activity, is here a mere minor incident. The students are already at work and are getting the technical knowledge that gives them a constantly increasing efficiency in an occupation chosen before their study began—a training all the more valuable from the fact that they are learning to apply this technical knowledge in their daily work.

The schools are maintained by tuition fees. The main building, used for instruction purposes only, is five stories high with a floor area of 34,500 square feet, and was erected in 1898 at a cost of $225,000. The building used for printing purposes was completed the same year and cost $80,000. A new building is now in process of construction. The company rents, besides, 15 other buildings, in whole or in part, in the city of Scranton. In addition, there are 17 district offices and 150 local offices at various points in the United States and Canada. These offices are engaged in enrolling students and looking after the interests of the school generally in their respective localities.

The field equipment includes six railroad cars, each with a complete air-brake outfit, and costing $10,000 each. These cars constitute a very important part of the system of instruction followed in the railway department. When arrangements have been perfected with the officials of a road, an enrollment car makes a tour of the entire line, stopping at points long enough to afford the employees an opportunity to visit it, examine the instruction papers, and obtain such other information as they may desire regarding the method of instruction. When the students enroll they are furnished with all necessary instruction and question papers, and at stated intervals the instruction cars follow over the road and supplement the regular instruction with lectures. These lectures are made of great practical value by the use of stereopticon illustrations and sectional models of modern train and engine apparatus, and working models of locomotives driven by compressed air. Up to the present time, these cars have operated on about 40 different roads and enrolled some 8,000 railway men.

Regarding the importance of maintaining the efficiency of the courses and methods of instruction it is said that a necessity of peculiar urgency with these schools is that of keeping their text-books and the matter and scope of their courses constantly up to date. The students are in actual contact with the latest and best methods in engineering and the arts, in the trades and industries, and they are quick to detect and prompt in reporting to the management anything at variance with the latest and best. Hence, constant revision, after careful and thorough investigation of everything new that is of recognized merit, is unavoidable, and is imperatively demanded of the management of the school. The principals are compelled to devote a large part of their time to study and to visiting industrial and commercial plants.

The object of the American School of Correspondence, located at Boston, Mass., is declared to be "to educate and advance the American mechanic." "The school makes no attempt to take the place of

a school for resident students, but aims to bring a technical education within the reach of every ambitious wage-earner. To the man on the farm, in the office, in the store—to every man who feels that he is like a cog on a wheel, always moving but never progressing—it offers an opportunity to fit himself for a change of occupation."

The full courses of instruction offered by this school are as follows: Electrical engineering, mechanical engineering, mechanical-electrical engineering, stationary engineering, marine engineering, locomotive engineering, textile engineering, and heating, ventilating, and plumbing. Complete instruction in mechanical drawing is included in every full engineering course.

For those who are unable or who do not desire to take one of the full engineering courses the following special shorter courses are offered: Arithmetic; arithmetic, elementary algebra, and mensuration; advanced algebra; geometry; complete mathematical—arithmetic, mensuration, algebra, geometry, logarithms, and trigonometry; arithmetic, elementary algebra, mensuration, and mechanics; general studies—arithmetic, elementary algebra, mensuration, mechanics, heat, chemistry, and metallurgy; elementary chemistry and metallurgy; mechanical drawing; mechanical drawing, including arithmetic, elementary algebra, mensuration, and geometry; plumbing, gas fitting, and lighting; heating and ventilation; elementary electrical; electric power and lighting; short locomotive; warp preparation and weaving; textile design and fabric structure; cotton spinning; woolen and worsted spinning; chemistry and dyeing.

As a preliminary to all the full engineering courses students take certain general studies to insure the proper foundation for the technical instruction. The outline of these general studies is as follows:

Arithmetic: Fundamental definitions; notation; numeration; fundamental processes; fractions; decimals; percentage; denominate numbers; involution; evolution; ratio; proportion.

Elementary algebra: Use of letters; substitution; cancellation; simple equations; known and unknown quantities; finding unknown quantities; equations containing roots of numbers; equations containing powers of numbers.

Mensuration: Definitions; straight, curved, and broken lines; plane and curved surfaces; parallel lines; angles; circular measure; measurement of lines, surfaces, angles, etc., including triangles, quadrilaterals and other polygons, circles, sectors, and segments; measurement of surfaces and volumes; volumes of solids, including prisms, cubes, cylinders, pyramids, cones, and frustums of pyramids and cones; measurement of surface and volume of spheres.

Mechanics: Preliminary definitions; universal properties of matter; characteristic properties; motion and velocity; force; gravitation; energy; principles of machinery; friction; transmission of motion; cohesion and adhesion; strength of materials; strength of pipes and cylinders; strength of beams; strength of columns; hydrostatics; pneumatics.

Heat: Expansion; liquefaction; vaporization; conduction; convection; radiation; latent heat; specific heat; thermodynamics.

Chemistry: Fundamental principles; atomic weights; chemical affinity; equations, factors, and products; solutions; physical and chemical properties, compounds, uses, and preparation of the elements; illuminating gas; combustion.

Metallurgy: Magnetite, hematite, limonite, siderite; iron pyrites, franklinite; preparation of ores; blast furnace; ores, fluxes, and fuels; operation of furnace; chemistry of blast furnace; slag and flux; cast iron; wrought iron; welding; cementation process; crucible process; open-hearth process; gas producers; special steels; case hardening; effects of the elements in steel; tempering.

A synopsis of several of the engineering courses will serve to show the scope of the work in this school:

MARINE ENGINEERING COURSE.

This course is prepared especially for marine engineers, firemen, stokers, oilers, coal passers, owners of launches, engine builders, boiler makers, shipbuilders, dealers in marine machinery and supplies, steamboat officers, inventors, designers, draftsmen, salesmen, instructors, and students. Its purpose is to secure advancement to the positions of chief engineers and assistants, inspectors of boilers and machinery, superintendents of shipyards, consulting engineers, etc.

The outline of the subjects of instruction is as follows:

Construction of boilers: Materials of construction, plates, joints, and rivets, design of boilers.

Types of boilers: Early types, modern boilers, marine boilers.

Boiler accessories: Furnaces, valves, blow-out apparatus, water, steam, and vacuum gauges, fusible plugs, steam separators, steam traps, feed apparatus, horse power of boilers, corrosion and incrustation, fuels, care of boilers.

Marine boilers: Classification, materials of construction, boiler construction, boiler dimensions, efficiency of furnace, detail parts, feeding marine boilers, lagging, draft, mechanical stokers, fuels, care of boilers, cleaning fire, water-tube boilers, launch boilers.

Machine design: Operations and functions of machines, materials of construction, shop processes, strains in machines, machine drawings and designs.

The steam engine: Physical theory, detail parts, lubrication, condensers, types of engines.

Steam engine indicators: Indicator diagrams, modern indicators, steam engine constants, measuring area of card, indicator cards, faults, calculations.

Valve gears: Slide valve, valve diagrams, designing and setting slide valves, reversing gear, modifications of slide valve.

Details of the steam engine: Expansion of gases, work done in cylinder, loss of efficiency, compound engines, jacketing and superheating, lubrication, condensers, details of design, care and testing.

Marine engines: Methods of propulsion, nautical terms, details, condensers, auxiliary machinery, propulsion, propellers, engine-room fittings, management of engines, emergencies.

Elements of electricity: Magnetism, static electricity, dynamic electricity, magnetic effect of electric current, induced currents, heating effects, thermo-electric effects, chemical effects, telephones, telegraph.

The electric current: Terms and definitions, standard cells, electric energy, power, supply of electric energy.

Theory of dynamo-electric machinery: Symbols, physical theory, the generator.

Direct-current generators: Characteristics, generator construction, installation, and operation.

Direct-current motors: Fundamental principles, motor equations, torque and speed, discussion of shunt and series motors, compound motors, motors on constant current circuits, rotary transformers, calculations of electric motors.

Types of dynamo-electric machinery: Constant potential generators and motors, constant current generators.

Optional courses in electric lighting, algebra, geometry, and mechanical drawing are also offered in connection with this course.

TEXTILE ENGINEERING COURSE.

This course is prepared especially for foremen and overseers in weave mills, cotton mills, and woolen-yarn mills, for boss weavers and weave-room hands, agents, manufacturers, merchants, and salesmen, boss carders and spinners, mill engineers, machinists and master mechanics, instructors, and students in textile design. Its purpose is to secure advancement to positions of superintendents, foremen, and overseers in textile mills and manufactories.

The outline of the subjects of instruction is as follows:

Warp preparation and weaving: Gray yarns, spooler, warper, colored yarns, long chain, short chain, slasher, woolen and worsted spinning, hand rail, hand beaming, steam dresser, drawing in and twisting in warps, looms, shedding motion, picking motion, beating up, gear let-off, friction, take-up motions, filling stop motion, assembly of parts and correct timing, shuttle boxes, box motion, pin-gear motion, vibrator-gear motion, protector for boxes, box chains, multipliers.

Textile design and fabric structure: Design paper, weaves, color effects on plain and other weaves, sateen weaves, rib weaves, basket weaves, diaper weaves, extension of fancy weaves, origination of new weaves and designs, reduced chain to fewest number of harnesses and drawing-in drafts, textile calculations, analysis and calculations, specifications and lay out, combinations of several weaves for one design, cloths backed with filling, cloths backed with warp, double-make cloths, principles of double-cloth cut designs, double-plain hair lines.

Cotton spinning: Methods of cultivation, ginning, baling, structure of fiber, commercial varieties, grading, mixing, bale breaker, automatic feeder, trunk systems, breaker picker, finisher picker, theory of carding, early forms of cards, revolving flat card, card clothing, stripping, grinding and burnishing, gauge settings, calculations, combing process, lap preparation, comber, timing and setting, calculations, importance of drawing operation, railway head, evener motion, railway details, drawing frames, rolls, cleaners, stop motions, hanks and numbers, roving machinery, fly-frame construction, draft, twist, tension, lay, taper, spinning processes, ring frame, traveler principle, builders, rail motion, draft and twist, frame details, mule spinning, mule construction, operation, details, drawing, twisting, backing off, winding, reengaging.

Woolen and worsted spinning: Wool, fibers allied to wool, substitutes for wool, cleansing wool, carbonizing, drying, carding, grinding, card clothing, setting up cards, preparation for carding, mixing, oiling, mixing and other pickers, cards, automatic feeds, feeds between cards, condensers, doffers, spinning, drawing, draft, self-acting mules, quadrant, builder rail, double spinning, doffing, calculations for woolen yarns, woolen and worsted threads, worsted yarns, carding, gilling, back washing, combing, gilling and top making, principles of drawing, calculations for draft, principles of spinning, types of spinning frames, doubling and twisting, yarn testing.

Textile chemistry and dyeing: Cotton fiber, flax linen, wool, silk, preliminary operations for dyeing, cotton bleaching, wool scouring, wool bleaching, carbonizing, silk boiling or degumming, theory of dyeing, mordants, indigo, logwood, natural dyestuffs, coal tar, artificial colors, basic colors, direct cotton colors, acid dyestuffs, phthalic anhydride colors, ingrain colors or developed azo colors, mordant dyestuffs, miscellaneous colors, machinery used in dyeing, water.

In addition to the above the student may take the course in mechanical drawing and has the choice of an electrical course, including the elements of electricity, electric current, theory of dynamo-electric machinery, electric lighting, central stations and power transmission, or a mechanical course, including pattern making, foundry work, forging and machine-shop work.

These schools have never been opposed by labor unions in any community. On the contrary, where their methods and work are best known, they have received warm indorsements from officials of the representative bodies of organized labor.

With respect to the preference of students and graduates of these schools by employers, and the improvement in ordinary shop training, it is said:

The workman with mere shop training has only what might be called the practical side of his occupation, while the student workman, if he has properly mastered his course, is doubly equipped. He has trained his muscles into coordination with a brain informed by science. He has risen above a mere routine into a domain of resourcefulness, inventiveness, and expediency. Men so trained are always preferred by intelligent and discriminating employers, for it is an industrial axiom that "mere skill without science is only one remove above unskilled labor." Improvement of ordinary shop training, or any other matter affecting large numbers of men, is necessarily and fortunately a slow process—a gradual evolution. It begins with isolated individuals and gains general approval, adoption, and headway in proportion to its intrinsic merit and on condition that it is really required by existing conditions. That shop training, not only in this locality but throughout the country and in some measure abroad, has been improved by these schools is an easy, a necessary induction from their unexampled prosperity.

There are so many cases where the system of instruction pursued by these schools has enabled the students to advance from the lower branches of a trade or occupation to a complete mastery of the same that it would be impossible to estimate the benefits that have accrued to those who have been under instruction. In the higher positions are to be found foremen, superintendents, master plumbers and builders, architects, and electrical and mechanical engineers, who bear witness to the worth of this instruction. Men already engaged in trades as machinists and pattern makers have been enabled to rise to mechanical draftsmen and designers; carpenters, cabinetmakers, and bricklayers have become architects; miners have been promoted to foremen and superintendents; and in electrical occupations linemen, repairmen, and motormen have been advanced to inspectors, foremen, and electricians. On the other hand, many students have been able to change from one occupation to an entirely different one. Clerks, salesmen, telegraph operators, farm laborers, and others have been qualified for positions as mechanical and architectural draftsmen, etc. There are thousands of students, also, whose earnings and prospects have been increased from 50 to 200 per cent by the instruction they have received. The increased efficiency of the students and graduates is recognized on every hand, and when it is considered that in such occupations as mechanical drawing, in some phases of engineering, in electrical occupations, and in occupations in which drawing, designing, and lettering are the most important elements, it is possible for the graduates to engage in practical work without undergoing a period of apprenticeship, there is ample ground for saying that the methods of instruction employed in these schools are productive of practical and substantial benefits to those who are under instruction.

SCHOOLS OF INDUSTRIAL DRAWING AND DESIGN.

Schools of industrial drawing and design vary a good deal in scope. The simplest type is represented by the evening classes of industrial drawing in the public schools of Massachusetts, and Franklin Institute, of Philadelphia, has long done work of the same character, perhaps less elementary in grade. The public evening drawing schools represent the class of instruction now given in a number of Massachusetts cities. It is, moreover, quite distinct from the work in drawing done in the regular public day schools or in connection with the manual training courses in the public schools. The Massachusetts law now provides (chapter 496, Acts of 1898) that any town or city may, and every town and city of 10,000 or more inhabitants shall, maintain evening schools for the instruction of persons over fourteen years of age in industrial drawing, both free-hand and mechanical (among other studies).

Another type is represented by the schools of art and design, of which Cooper Union, of New York City, and Maryland Institute, of Baltimore, are excellent examples. In these we find the regular art school in combination with elaborate courses in design. These latter have, in most cases, been more recent developments. A third type is the school of design exclusively. Lowell School of Design, of Boston, and the Philadelphia School of Design are good examples.

Several schools having courses in industrial drawing and design are elsewhere shown in connection with some other class of industrial school which represents, for the purposes of the present report, their more important work. Thus, Pratt Institute is under "Building and mechanical trade schools" and the Pennsylvania School of Industrial Art under "Textile schools."

COOPER UNION, NEW YORK, N. Y.

The Cooper Union was founded in 1854. The charter in its present form was adopted by the legislature of the State of New York April 13, 1859.

The events which led up to and which appear to have been the impelling force in establishing this institution are perhaps best stated in a recent biography of the founder:

Starting in when a boy, Peter Cooper worked at various trades. He mastered them all and eventually became a business man, an inventor, and a successful manufacturer. At every stage of his progress, however, he found himself hindered by a lack of knowledge and education. As an apprentice he regarded with intense sympathy the needs and limitations of the class to which he belonged, and he resolved to do something for apprentices. He was possessed with the desire to found an institution which would supplement the deficiencies of early education, furnish to virtuous, industrious, and ambitious youths the means of progress, and attract the thoughtless or indolent into the same ascending road. * * *

The classes which he wished especially to reach were those who, being already engaged in earning a living by labor, could scarcely be expected to take regular courses in instruction. He had a strong impression that young mechanics and apprentices, instead of wasting their time in dissipation, should improve their minds during the intervals of labor; and not unnaturally his first thought as to the means of such improvement turned to those things which had aroused and stimulated his own mind.

The anxiety of Mr. Cooper to provide ample means for the education and training of young women is shown by the following abstract from one of his letters:

To manifest the deep interest and sympathy I feel in all that can advance the happiness and better the condition of the female portion of the community, and especially of those who are dependent on honest labor for support, I desire the trustees to appropriate two hundred and fifty dollars yearly to assist such pupils of the female school of design as shall, in their careful judgment, by their efforts and sacrifices in the performance of duty to parents or to those that Providence has made dependent on them for support, merit and require such aid. My reason for this requirement is not so much to reward as to encourage the exercise of heroic virtues that often shine in the midst of the greatest suffering and obscurity without so much as being noticed by the passing throng.

In order to better the condition of women and to widen the sphere of female employment, I have provided seven rooms to be forever devoted to a female school of design, and I desire the trustees to appropriate out of the rents of the building fifteen hundred dollars annually toward meeting the expenses of said school.

It is the ardent wish of my heart that this school of design may be the means of raising to competence and comfort thousands of those that otherwise might struggle through a life of poverty and suffering.

By the terms of Mr. Cooper's trust deed, the following objects were specified to be established in the order of enumeration:

First, to provide courses of instruction at night free to all who shall attend the same, in such branches of knowledge as in the opinion of the board of trustees will tend to improve and elevate the working classes of the city of New York.

This provision has been carried into effect by the night classes for working men and women, which during the last forty-one years have been attended by nearly 100,000 different persons.

Second, to the support and maintenance of the free reading room, galleries of art, and scientific collections, designed to improve and instruct those whose occupations are, in the opinion of the board of trustees, such as to deprive them of proper recreation and instruction.

Under this provision the free reading room and library, resorted to by about 3,000 visitors daily, has been established and maintained, and within the last five years the museum of decorative art has also been open to the public and is now in practical use by many artisans and others who are employed in artistic occupations.

Third, to provide and maintain a school for the instruction of women in the arts of design.

Under this provision the Women's Art School has been established and now affords instruction to about 250 young women as a preparation for employment and in work requiring a knowledge of drawing and of colors. A school in telegraphy and in stenography and typewriting for women is also maintained and affords instruction to about 100 graduates annually.

The fourth provision looks to the establishment and maintenance of a polytechnic school by day, so that the space used at night might also be employed in the daytime for the purpose of technological education. It is distinctly provided that this portion of the work shall not be undertaken until the income of the institution will warrant the expense without curtailing the operation of the departments heretofore enumerated.

The evening schools are divided into two sections, namely, the scientific department and the art department. The instruction given in the scientific department is of the advanced order and entitles those who complete the full course to receive the degree of Bachelor of Science. As it is not the purpose of this report to include the higher scientific branches of study, the data relating to this department will not be considered in detail.

Tuition is free to all. Residence in New York City is not a necessary condition of admission. A letter of recommendation from an employer is required from applicants in the evening classes, and a written reference as to character and a guarantee that the applicant is not able to pay for instruction and is obliged to earn her own living is required from applicants in the day school. All materials, except easels and models, must be furnished by the pupils. The school term commences on the 1st of October and ends the last week in May. Sessions are held every day except Saturday. The hours are from 9 a. m. to 1 p. m. for the day classes and from 7.30 to 9.30 o'clock for the evening classes. Pupils in the day classes are allowed to remain for practice until 4 p. m. Applicants for admission in the evening art school must be at least 15 years of age, and in the day school at least 16 and not over 35 years of age.

The day school is exclusively for females. The evening school is exclusively for males, except the classes in perspective and elementary architectural drawing, to which women are also admitted.

In the evening school instruction in the drawing classes covers the following subjects: Rudimental drawing, for beginners in free-hand drawing from simple models; form drawing, or free-hand drawing from bas-reliefs, representing architectural and plastic ornaments of different historic periods; cast drawing, or drawing from the antique; decorative designing, for designers of ornamental patterns for fresco

work, paper hanging, or figures for textile fabrics; ornamental drawing, or drawing from copies of pictures of ornamental forms; modeling in clay, for workers in relief decoration, whether in terra cotta, freestone, or marble; architectural drawing; mechanical drawing; elementary architectural drawing; elementary mechanical drawing; perspective drawing.

In the day school there are the following art classes: Elementary cast drawing; drawing from the antique; life drawing; oil painting (still-life class, portrait class), two years' course; modeling in clay.

Industrial classes in the day school are as follows: Class in design (two or three years' course) comprehends a course in historic ornament and, incidentally, the use of instruments, drawing to scale, and the use and application of water color; also designs for book covers, silks, carpets, wall paper, etc. Class in decorative composition, architecture, interior decoration, furniture, stained glass, and metal work (two years' course). Illustrating class; retouching of positives; water colors, crayons, and india ink, from the photograph; porcelain painting, from life; pastel and miniature painting, from life.

Lectures on perspective are given to the whole school, and such other lectures on art as may be provided by the trustees.

The schools are under the general management of a president and a board of trustees. There are 23 instructors in the art schools, all of whom are professional artists, architects, and teachers whose training was obtained in the leading art schools in this country and abroad and in practical work. The number of pupils in each class during the past year was as follows:

PUPILS IN EVENING CLASSES.

Cast drawing	136
Form drawing	120
Decorative designing	252
Ornamental drawing	200
Rudimental drawing	200
Modeling in clay	90
Mechanical drawing	240
Elementary mechanical drawing	70
Architectural drawing	300
Elementary architectural drawing	200
Perspective drawing	65
Total	1,873

PUPILS IN DAY CLASSES.

Elementary cast drawing	77
Drawing from the antique	29
Life drawing	27
Still-life class	20
Portrait class	15
Modeling in clay	17
Design, historic ornament, etc	39

Decorative composition, etc	17
Illustration	27
Retouching, water color, porcelain, etc	24
Total	292

The record of graduates is incomplete, but it is estimated that at least 8,000 pupils have completed the art school courses. The erection of the building was commenced in 1854 and was completed in 1858. The building and equipment represent an outlay of $1,075,428, which amount was provided by the founder. The art schools occupy 22 large rooms, which have an aggregate floor space of 30,000 square feet. The cost of maintaining the art schools is about $25,000 per annum, which amount is derived from rents and the income from endowments. The sustaining endowments to date amount to $2,022,450. Two-thirds of this amount has been contributed by the Cooper family. The next largest benefactor is Mr. Andrew Carnegie, who has contributed $300,000 for the purpose of enabling the trustees to establish a day polytechnic school, and thereby fulfill the final provision of Mr. Cooper's trust deed.

Regarding the courses of training and study, the trustees feel that twice as much space is needed so that the work of instruction carried on at night may be extended into the day. The curriculum which has been established, although very satisfactory, has never been quite as extensive as it ought to be in order to meet the demands of such of the students as might possess a high order of ability. Certain changes in the length of the school term, large extensions in the chemical and physical laboratories and the establishment of an art laboratory are deemed necessary. Heretofore the art department has been carried on with reference mainly to such instruction as will enable the pupils to gain a livelihood in artistic pursuits. Hence, the application of the fundamental principles of the graphic arts has been made, both in the day and night school, a leading and practical feature of the instruction heretofore given. During the last few years the subject of interior decoration has come into great prominence by reason of the large number of public and private edifices erected in this country without regard to cost. Skilled workmen are required for this purpose. They have been very largely supplied from abroad, where schools of applied art have existed in all the leading countries of Europe for many years. No such school has been successfully maintained in this country on a scale commensurate with the demand which now exists for this kind of skilled labor. When this requirement was perceived about five years ago, the granddaughters of Peter Cooper undertook to form a museum of decorative art, without which it is quite impossible to carry on any systematic instruction with any prospect of success. This museum has now reached such a development as makes it possible to establish in

connection with it what might be termed an art laboratory, corresponding to the chemical and physical laboratories. The work in this laboratory will be directed to the application of art to the purposes of decoration, and will necessarily cover a very wide field. When these changes and extensions have been made, a very much larger number of pupils will be accommodated at night, and the whole of the space occupied by them will be available by day for those who may be able to give the time necessary for the work. The outlook is very flattering, indeed. The income of the institution has been materially increased by recent benefactions, and the trustees have good assurance that certain friends and admirers of the founder will provide ample funds for making all needed improvements.

It would be impossible to attempt to enumerate the many and far-reaching benefits which have accrued to local industries or to the community or the working classes generally from the establishment of the school. The graduates of Cooper Union occupy high and important positions in every line of industry and art, and they can be found in every section of the country. Some of the most successful manufacturers in the city obtained their education and first start in life in the class rooms of Cooper Union, and they are to-day among its foremost advocates and admirers. Probably nowhere in the world, certainly not in this country, have so many persons been provided with free access to literary, political, social, industrial, and scientific instruction as has been given in the Cooper Union during the years that it has been in existence. The free-lecture courses alone have been an invaluable factor in the dissemination of useful knowledge. These lectures, which treat upon every known important subject, are given by leading thinkers, debaters, orators, and writers, and have been attended by hundreds of thousands of auditors from all walks of life.

In addition to the free lectures, the library and reading room constitute a very important part in the diffusion of knowledge and information upon every known subject. During the past year more than 500,000 visitors took advantage of the many facilities afforded by this department. The ultimate effect of the efforts put forth by the trustees of Cooper Union in thus affording such a wise and comprehensive system of gratuitous instruction upon topics and things which are of acknowledged necessity and worth must certainly tend toward the promotion of the industrial, educational, and social development of all classes in the community.

The Cooper Union has always been recognized by labor unions as a valuable aid in promoting the welfare of the working classes and has always received their hearty support. Among the improvements contemplated when the day school is enlarged is a proposition to establish 100 scholarships for the support of young men who desire to take

advantage of the free instruction offered, but who might need assistance for their support. These scholarships will be awarded to deserving young men, and particularly upon the nomination of the various trade unions in the city and elsewhere.

The effect upon those who have been under instruction has been beneficial in every respect. The testimony of the graduates upon this point is unanimous. Many were found who had achieved remarkable success in their particular line, and they were profuse in expressing their appreciation and admiration of the instruction they had received in the school.

The evening classes are made up almost entirely of pupils who take up the instruction in conjunction with their trade work during the day. Some are apprentices and others are mechanics who desire technical instruction which can not be acquired in the workshops. There is ample evidence that the instruction received by these apprentices and mechanics gives them preference by employers over those who have had the benefit of a shop training only.

With the graduates of the day classes the conditions are somewhat different. The work that the young women take up requires more or less of an art education, which must be obtained either in a school or under private instruction, and therefore there are comparatively few shop-trained apprentices or workmen to be encountered. The graduates do not enter the trades in the same manner or to the same extent as the young men. They usually take up work on their own account, and as they become proficient in practical application many of them accept regular positions. It is possible for the graduates in many cases to take up regular work without undergoing a period of apprenticeship, and in almost every instance the instruction received by the young men has resulted in shortening their term of apprenticeship from one to two years.

The Cooper Union has proved eminently satisfactory, but it has not yet attained the end for which it was established. Thus far the first three provisions of Mr. Cooper's deed of trust have been realized, but the fourth provision, which looks to the establishment and maintenance of a day polytechnic school, is still in abeyance. Fortunately, however, through the benefactions of friends, the time has arrived when the prospect of fulfilling and carrying out the wishes of the founder is most assuring. The improvements now under advisement contemplate such changes as will make it possible for a still greater number of workmen to acquire a good, sound, theoretical and technical education in many departments of industry and to perfect themselves in special branches of knowledge. The intention is to maintain a free school, primarily for the education of workmen, and not a professional institution for the education of engineers, although it is to be expected

that in the future, as in the past, its graduates will, by their training and ability, be fitted for the most responsible positions in practical industrial work.

MARYLAND INSTITUTE FOR THE PROMOTION OF THE MECHANIC ARTS, BALTIMORE, MD.

The Maryland Institute for the Promotion of the Mechanic Arts was founded in Baltimore in 1826. The plan of organization provided for a school of design; an annual course of public lectures; a library and reading room, with cabinets of models and philosophical apparatus; and arrangements for the holding of an annual exhibition, with premiums for excellence in manufactures and mechanic arts. The night school of industrial drawing was organized in 1847, and subsequently, in 1854, a day school of art and design was established. The express purpose of the schools is to afford thorough instruction to reputable white students in the various branches of artistic and industrial drawing, painting, modeling in clay, and sculpture, with a view to qualifying them as teachers, draftsmen, designers, decorators, or skilled artisans generally.

Since their organization both schools have continued uninterruptedly with great success. They have afforded instruction to nearly 29,000 students, many of whom have risen to eminence as artists, engineers, manufacturers, and builders throughout the country. The outfit devoted to the interests of the schools represents an outlay of $175,000. The equipment includes a library containing nearly 21,000 volumes, and a museum of art and design with a fine collection of all the most important casts of antique figures and heads, specimens of designs in wrought iron, stained glass, ceramics, terra cotta, textiles, wall papers, complete models of machinery, structural details of buildings, etc.

The school year commences the first week in October and ends the last week in May. The day classes meet five days in the week from 10 a. m. to 3 p. m. The term of the evening classes begins October 15, and continues three evenings each week until the middle of March. Applicants for the evening classes in free-hand drawing must be not less than 14 years of age, and for the mechanical and architectural divisions not less than 15 years of age. All materials, instruments, etc., must be provided by the students.

Premiums in the form of gold medals are awarded to students in the day classes, and in the night school premiums are awarded to graduates in accordance with the provisions of the gift of the late George Peabody, through whose liberality the managers are enabled to distribute $500 annually in money premiums, in sums of not more than $100 nor less than $50, to the most meritorious graduates.

The regular courses of instruction cover a period of four years. The day classes are arranged for four classes of students, namely: Regular students who contemplate continuing during the full course of four years; special students who do not wish to attend regularly and prefer to study a special subject; Saturday students, consisting mostly of juniors; and a class in sculpture. Special students have the privilege of attending the art lectures given in connection with the studies in the regular classes.

Excepting the free scholarships allowed to the city of Baltimore and to each county in the State, the charges for tuition are as follows: Day school, regular students, $28 per session of eight months. The fees to special students range from $6 per term in elementary drawing to $50 for the course of eight months in sculpture. In the night school the fee is $6 per term of five months. In addition to the above there is a graduation fee of $5.

The courses of instruction are as follows:

DAY SCHOOL—ART DEPARTMENT.

Elementary drawing: Drawing in outline from geometric solids; drawing in outline of ornament from cast; drawing in outline, still-life group, from objects; drawing in outline, details of human figure, from cast; drawing in outline of natural foliage, from a plant; drawing from objects, shaded in charcoal; drawing from objects, shaded with brush; drawing of ornament from cast, shaded in charcoal; an elementary design, within a geometric form; analysis of a plant and applied designs; geometry, plane and solid; perspective, theory and applied. A representative or certificate drawing of each of the above subjects, made in the best manner possible, on half imperial sheets mounted on bristol board, 14 by 22, must be submitted by every regular student and accepted by the principal before the student can take the examinations and advance to the higher class. The drawings having been submitted and approved, examinations are held at the end of the school year in the following subjects: Model drawing in outline, from solids; model drawing, shaded, from solids; perspective problems; elementary design. Test examinations are also held at stated periods during the term, and an average of 85 per cent must be obtained in order to admit the student to the final examination.

Figure drawing and painting in water color: Charcoal—head from cast; human figure from the antique. Water color: Still-life group from objects; landscapes from an approved example or from nature; fruit, flowers, and foliage from nature; perspective, shadows and reflections, landscape sketch from nature. Applied designs—design for textile fabric, wall paper, or carpet, etc.; surface decorations of some object or ornament. There are two time-sketch exercises per week, one in charcoal drawing from the cast, the other in water color, painting from still life, fruit, and natural flowers. An average of 85 per cent must be obtained to entitle the student to the final examination. A finished example of each of the above subjects, mounted on imperial board, 22 by 28, must be submitted by every regular student and accepted by the principal before the student can take the examinations and advance to the higher class.

Painting in oil and drawing from antique in charcoal: Head from cast, shaded; figure from antique, shaded; two still-life groups from objects, in oil; fruit and flowers from nature, in oil; two landscapes from approved example, or nature, in oil.

There are two time-sketch exercises per week, one in oil painting, and the other in drawing from antique in charcoal. An average of 85 per cent must be obtained to entitle the student to the final examinations.

Modeling in clay, drawing from life, and designing in the round: Study of ornament from flat design or cast; head from the cast, antique, in bas-relief; figure from the cast, antique, in bas-relief; portrait head or bust from life in bas-relief or round; original design in clay of a tile, rosette, or ornamental panel; portrait head from life, shaded in charcoal; figure from life, shaded in charcoal.

There are three time-sketch exercises per week, one in modeling, one in heads from life, and one in figure drawing from life in charcoal. An average of 85 per cent must be obtained to entitle the student to the final examinations.

Such works of each certificate set as the principal shall select are retained for the use of the institute for two years; after two years, such as the committee on schools of art and design may elect to retain permanently are paid for at rates fixed by said committee, and the others are returned.

NIGHT SCHOOL—INDUSTRIAL DRAWING DEPARTMENT.

Free-hand drawing: First year—elementary drawing in outline, of ornaments and objects from blackboard and models; elementary designing and perspective. Second year—drawing of groups of geometric solids, ornaments, and objects from models; shading in charcoal and perspective. Third year—study of light and shade from ornament, still-life composition, and drawing from antique. Fourth year (certificate works in charcoal)—drawing a piece of ornament, shaded, from cast; drawing a still-life group, shaded, from objects; drawing a head from antique; drawing a figure from antique.

Mechanical drawing: First year—geometrical problems and orthographic projections; sketches and drawings of machine details. Second year—projection and intersection of solids and development of surfaces; projection of screws, belts and pulleys, gears and gearing. Third year—sketching, measuring, and drawing of details of machines from models; elements of mechanical motions and construction. Fourth year—certificate works on imperial sheets, comprising a complete set of detail drawings and general plans of a machine, made from a model by measurement.

Architectural drawing: First year—geometrical problems, plain and solid; moldings and timber joints; details of construction, sections, etc. Second year—structural details, with sections in wood and stone; construction of stairs, trusses, arches, etc.; plans and elevations. Third year—plans, elevations, and sections of houses; orders of architecture and ornament; manner of treatment in drawing elevations. Fourth year—certificate works on imperial sheets, comprising a complete set of plans, elevations, and sections of a building developed from a perspective view or other given data.

One drawing of each certificate set may be selected by the principal to be retained as the property of the school.

The institute is under the general management of a board of managers, consisting of 24 members, two-thirds of whom must be either manufacturers or mechanics. The faculty consists of a principal and 31 instructors, 26 of whom are engaged in the courses covered herein. All the instructors are graduates of the institute and several are graduates of foreign schools also. The instructors in the evening classes are engaged in practical work either on their own account or in industrial establishments during the day. The number of students in each grade during the past year was as follows:

ATTENDANCE IN DAY AND EVENING SCHOOLS OF MARYLAND INSTITUTE FOR THE PROMOTION OF THE MECHANIC ARTS.

Grade.	Day school.	Evening school.			Total.
	Art and design.	Free-hand drawing.	Mechanical drawing.	Architectural drawing.	
First year	29	90	218	73	410
Second year	12	37	67	38	154
Third year	11	24	41	12	88
Fourth year	9	17	18	11	55
Total	61	168	344	134	707

In addition to the above there were 12 students taking special instructions in illustration and 309 students in the special day classes. The number of graduates is about 1,200.

The cost of maintenance for the courses covered by this report is about $18,000 per annum. The income of the institute is derived from the following sources: The city of Baltimore appropriates $9,000 per annum, in return for which 33 free scholarships are allowed each year. These scholarships are apportioned among the members of the city council to be distributed among their constituents. The State of Maryland appropriates $8,000 per annum, in return for which each county in the State and the three legislative districts in the city of Baltimore are allowed one free scholarship each year. These scholarships are distributed by the board of county school commissioners and the Baltimore city school board. The balance is derived from tuition fees and contributions from leading citizens of Baltimore.

In the opinion of the officials, the courses of training and study are satisfactory in every respect. The only thing needed is additional equipment in the shape of mechanical and electrical models and appliances, and these the management hopes to obtain in the near future. Regarding the benefits accruing to local industries as a result of the establishment of the institute schools, it is said that besides furnishing them with a ready supply of skillful draftsmen, they have also afforded a convenient opportunity to thousands of apprentices and mechanics who were employed in the manufacturing establishments of the city during the day to acquire a good working knowledge of mechanical and architectural drawing, which has made them more proficient in their trades and more valuable to their employers. While no effort has been made to trace the influence of the institute in other directions, it is the prevailing opinion that daily contact with the students has tended to raise the general standard of efficiency among their fellow-workmen. A number of the leading manufacturers of the city were visited in this connection, and they were unanimous in the opinion that the institute schools have been a great benefit to the local industries.

Though many members of local labor unions have attended the evening classes, and some of them speak in the highest terms regarding the instruction they received, the labor unions as such have never taken any official action regarding the schools.

The effect upon those who have been under instruction is said to be beneficial in every particular. Their knowledge of drawing gives them preference over ordinary apprentices and workmen, and they receive good wages and have steady employment. It is difficult for a young man to obtain a position in a drafting room unless he has acquired a good knowledge of drawing beforehand, and the fact that he is a graduate of the institute is a sufficient recommendation with employers.

As is the case in many schools that have evening courses in industrial drawing, a large number of the students are apprentices and mechanics who are employed at their trades during the day. While there is always a fair number of this class that pursue the studies with the intention of mastering all the details of a particular course and fitting themselves for positions as draftsmen, designers, etc., many others have no further object than to acquire such a knowledge of drawing as will enable them to read and understand the details of the plans which they are obliged to follow when working at their trade. This, in a measure, accounts for the gradual falling off in the number of students as between the first and fourth-year classes. In most cases it has been possible for graduates to engage in practical work without undergoing a period of apprenticeship. Sixteen members of the last graduating class obtained positions as draftsmen before the completion of their studies at the institute.

The institute schools have proved eminently satisfactory, and have fully attained the end for which they were established. The success of the schools is well attested by the constantly increasing interest manifested by the public generally, and the steady growth of the different classes. During the past year, which marked the fifty-third anniversary of the night schools, the attendance was the largest in the history of the institute, and the indications point to still greater attendance for the coming year.

RHODE ISLAND SCHOOL OF DESIGN, PROVIDENCE, R. I.

It was believed by the people interested at the time this school was started that to enable the manufacturers of textiles in this country to compete with the foreign-made goods it was necessary to improve both the quality and the design of the goods made by them. In order to do this it was necessary to obtain a larger supply of technically and artistically trained workmen than this country afforded, and in order to help to that end this school was established. A so-called centennial committee of ladies from this State, which had been formed to look after the interests of the State at the Centennial Exposition of

1876, discovered that it had a balance of $2,100 in the treasury after the close of the exposition. To this sum an organization of women in Bristol, R. I., added about $300, and with the money thus obtained the art department of a business college in Providence was purchased and this school established. That was in 1877. The school is now practically self-supporting; but for a number of years it was largely supported by gifts from Mr. Jesse Metcalf, of Providence, and his family. The family also gave the present buildings to the school. In 1892 the school was regularly incorporated.

When the school was founded its purposes were declared to be, "first, the instruction of artisans in drawing, painting, modeling, and designing, that they may successfully apply the principles of art to the requirements of trade and manufactures; second, the systematic training of students in the practice of art, that they may understand its principles, give instruction to others, or become artists; third, the general advancement of art education by the exhibition of works of art and art studies, and by lectures on art." In the subsequent history of the school these purposes have been strictly adhered to.

The school has two buildings, the school building proper and the museum, located in the rear of the school building.

The museum contains a large collection of paintings, drawings, etchings, statuary, embroideries, etc., which are owned by the school and many others which are loaned to it.

The school is partially supported by the Association of the Rhode Island School of Design, which during the year 1899–1900 had a membership of 308. The membership dues paid by these members—$3 annually or $100 for a life membership—go to the support of the school. Other subscriptions are also received, amounting for the year 1899–1900 to $520, $100 of this being given as prizes for work. The State of Rhode Island appropriates $500 yearly for the school, and further appropriations are made both by the State and by the city of Providence for scholarships. The State scholarships are for all classes, day and evening, except the Saturday classes for children, but the city scholarships are offered only to those who join the evening classes.

The further funds necessary to maintain the school, the cost of which for the school year ending October 1, 1899, was $11,423.84, are provided by the fees.

In this school there are day and evening classes and classes for children, which meet on Saturdays only. The day classes are in session from 9 a. m. to 1 p. m. and the evening classes from 7.15 to 9.15 on every week day except Saturday. The Saturday classes for children meet in the morning from 9.30 to 11.30. The school year is divided into two terms of four months each. The fee for the day class is $25 a term; for the children's Saturday class, $5 a term; for the pen-and-ink class, $5 a term; for the evening class in mathematics, $5 a term; and

for the other regular evening classes, $9 a term. Each evening class meets three evenings a week. Students passing through an entire course to the satisfaction of the teachers and the board of management receive a diploma. Certificates of the amount and quality of work accomplished are also awarded.

The school is under the management of a head master and of a committee of management of the board of directors. There are 13 instructors in the school, as follows: A head master and instructor in architecture, perspective, and drawing, a graduate of the Worcester Polytechnic Institute, and also trained by shop practice, designing, and by thirteen years of teaching; an instructor in anatomy and drawing and painting from life, educated in the art school of the Boston Museum of Fine Arts and by two years' work in Julien's studio in Paris; an instructor in modeling, trained in German schools; an instructor in decorative design and wood carving, a graduate of the Pratt Institute, and of some years' experience in practical work as a designer; an instructor in engineering, mathematics, and design, a graduate of the Worcester Polytechnic Institute, and experienced in work on making steam engines and cotton-manufacturing machinery; an instructor in illustration and cast drawing, a graduate of this school; an instructor in painting in water colors, an artist; an instructor in descriptive geometry and drawing, a graduate of the Worcester Polytechnic Institute and of experience in an engineer's office; an instructor in mechanical drawing, a graduate of the Miller Manual Labor School at Albemarle, Va., and of this school; three instructors in the children's class, one a graduate of the Massachusetts Normal Art School, one a graduate of this school, and one a student in the same; an instructor in cast drawing, a graduate of this school.

There are two departments of instruction in the school, the free-hand department and the mechanical department. The following describes the courses in these departments:

FREE-HAND DEPARTMENT.

The work of the department of free-hand drawing begins with the drawing of simple objects and advances through various stages to the study of the human figure. Special attention is paid to the drawing of ornament for those who wish to make a specialty of design. The school has a fine equipment of ornamental casts in all styles for this work.

In both the day and evening schools there are separate classes for the study of the nude for both men and women. There are also day and evening classes in the study of the head and draped figure. Students are admitted to these classes after passing a satisfactory examination in drawing the human figure from casts.

Lectures are given on anatomy, illustrated by drawings on the blackboard. Students are expected to take notes and to pass satisfactory examinations.

There are classes in painting, both in oil and water color, from life and still life. There are also classes in outdoor sketching in the spring, when the weather permits. In order to enter the painting classes students must pass satisfactory examinations in drawing.

Students wishing to enter the course in decorative design will be required to show the necessary proficiency in free-hand drawing from ornament, and the study of drawing from ornament, cast, and life may be extended throughout the course. Instruction is given in water color, fresco, and oil painting and in the principles of harmony and contrast in color. A course of lectures on the evolution of decorative design from the earliest known evidences is given. Students are expected to attend the lectures, take notes, use the text-books, and pass examinations. Lectures are also given illustrating the principles of design and composition and their practical application. Especial attention is paid to the application of natural forms and of the human figure to decoration. Throughout the course practical finished work, aiming to meet the requirements of material and manufacture, is made. Students design surface patterns of all kinds, such as wall papers, prints, carpets, mosaics, and tiles. They also design furniture, interior and exterior decoration for buildings, stained glass, wrought ironwork, silverware, and jewelry, book cover and page illustration.

A firm grounding in elementary drawing and knowledge of decorative design are essential to the training of a wood carver. The course in wood carving, therefore, is carried on in connection with the work in drawing and design. The course of study is arranged so as to give students as broad a knowledge as possible of all varieties of carving, beginning with simple exercises in chip carving, and advancing through incised work, low relief, high relief, and carving in the round, to furniture and cabinet work.

There are two classes in pen and ink for illustration, one in the afternoon and one in the evening. The students entering these classes must pass an examination in drawing from still life in black and white.

The course in modeling begins with the modeling in relief from casts of ornament, and proceeds to the study of the human figure from the antique. Designs in clay and plastilina for wood and stone carving, for silverware, and terra cotta, are made.

The Saturday class for children is in four divisions and the course is a progressive one. Beginning in the lower division with the simplest models and objects, the pupils are advanced as fast as they are able to the study of more difficult tasks and applied designs. This class serves either as a preparatory class for the regular day class or as an elementary art school for those unable to come during the week.

The outline of the course in this department is as follows:

First year: Model drawing, ornament from cast, head from cast, figure from cast.

Second year: History of ornament, drawing figure from cast and head from life, anatomy, modeling (optional), elementary design (for designers and sculptors), drawing and painting from still life, perspective.

Third year (painters and illustrators): Drawing and painting from life and still life, composition, modeling (optional), pen and ink (optional).

Fourth year (painters and illustrators): Drawing and painting from life, composition, pen and ink (optional).

Third year (designers and sculptors): Composition of design, modeling (optional), wood carving (optional), pen and ink (optional), drawing from life.

Fourth year (designers and sculptors): Advanced work in practical designing in all branches, modeling (optional), wood carving (optional), pen and ink (optional).

MECHANICAL DEPARTMENT.

The general course begins with free-hand drawing from simple, correct models, and gives a training of eye and hand that is immediately and permanently useful to mechanic or artisan. The geometrical problems are stated and a solution described. The student must originate a figure and demonstration. Orthographic projections, intersections of solids, and development of surfaces are taught by models, patterns, and illustrations until the student learns how to think and to originate work. Elementary designing begins as soon as the student has gained sufficient facility in the

art of drawing. Good lettering receives constant attention, together with careful attention in making correct working drawings from the student's own measurements of machinery or other appropriate objects. In the second year every student is expected to take a regular course, even when he has in view a pursuit not properly classed in either of the three offered. By so doing a good foundation is laid for special work. The work is varied after the accomplishment of the prescribed course by more special work, which may be more directly in line with the student's aim or predilections.

The course for mechanics begins with making drawings from machines. Free-hand sketches of the parts are first made and dimensions taken, from which working drawings are made. Methods of duplications of drawings, the study of assembled and detailed drawings, and designing of cams and gearing are also taught. Designing of special machinery is taught during the third year, the work closing with a thesis.

The engineering course takes up graphic statics and its application to the stresses in roof and bridge trusses, the arch, and continuous girder. Algebra, geometry, and trigonometry are required, and the office work of the civil engineer is the class of work covered. In the third year, the study of earthworks, retaining walls, and foundations, the design of some structure, and a thesis. The study of algebra, geometry, and trigonometry continues through the second and third years. These subjects are also taught independently.

The course in architecture begins with the same fundamentals as given to mechanics, branching off when the subject of working drawings is reached into definite connection with architecture. Here additional free-hand work is required, study of ornament from cast, lectures upon historic ornament, also pen and ink work. A course in perspective, drill in the orders, designing in the classic, algebra and geometry, truss work in the graphic method, with calculations and strain diagrams, lantern lectures on the historic styles, competitions on set subjects, and design and thesis complete the course.

The outline of the course in this department is as follows:

First year: Free-hand drawing from geometric solids; graphical geometrical problems; orthographic projections from models, patterns, and machine parts; intersection and development; problems in solid geometry; isometric projection; working drawings.

Second year (architects): Free-hand drawing, use of color and brush, the orders, perspective, algebra.

Third year: Designing in the classic, designing trusses, building construction, graphic statics, geometry, design and thesis.

Second year (designers and engineers): Working drawings, cam design, gear design, elements of machine design, algebra.

Third year: Graphic statics and application to roof and bridge trusses, the arch and girder, retaining walls and foundations, geometry and trigonometry, design and thesis.

The number of students registered during the school year 1899–1900 was: Day classes, 79; evening classes, 335; Saturday classes for children, 94; a total of 508. The number of graduates since the establishment of the school is, approximately, 220, though about 4,500 have been in attendance. The great majority of those attending the school either drop out of it entirely before completing a course in any study, or else complete but a few of the studies making up a course and so are not regularly graduated.

The officials of the school believe that the courses of instruction can not be much, if any, improved, except that modeling should be a requirement. At the present time it is an optional study, because it has been found that most of the students would stay away from the school rather than take it as a study. The school has furnished many skilled designers for the manufactories of jewelry and they have undoubtedly had an influence in improving the standard of work. They are now working in all parts of the country and have spread the influence of the school. The school has had an effect on the intelligence of the working classes, though, perhaps, not a large one, as its pupils have been few in proportion to the whole number of working people in the country. Higher wages, steadier employment, and more rapid promotion have in many instances accrued to the graduates of the school as a result of their better preparation for work. Its pupils are much preferred by employers, owing to their greater intelligence and knowledge of drawing, and in at least one case, in the Brown & Sharpe Manufacturing Company, of Providence, it has led to the improvement of ordinary shop training in its locality. Its graduates do not, in the lines in which they have been trained, have to pass through a period of apprenticeship or of learning when beginning actual work at a trade or occupation. It has, generally speaking, proved satisfactory and has fully attained the end for which established.

SCHOOL OF DRAWING AND PAINTING, MUSEUM OF FINE ARTS, BOSTON, MASS.

The act incorporating the Museum of Fine Arts was passed in 1870, and in recognition of the great need of a school where those desiring it could secure an art education, provision was made for its location in the museum. The school was established in 1876, and rooms were provided for it by the trustees of the museum. Further than occupying these rooms the school has no connection with the museum. It is managed by a committee in charge and a manager.

The first object in establishing the school was to cultivate the taste of the community in all matters of art, and as a means to that end not only is instruction given in the various forms of high art, so called, but also in industrial art in certain of its phases.

On entering the school, each pupil is placed immediately in the class for which fitted, and advancement thereafter is regulated by the judgment of the instructors. Pupils in all departments are allowed the free use of the galleries, collections, and library of the museum, and during the morning hours are given the preference over the pupils of any other school in the choice of places for drawing in the galleries.

Diplomas are given, upon application, to those students who have fulfilled the requirements of the committee. In the department of

decorative design these requirements include satisfactory work during the prescribed course and satisfactory examinations in perspective. Strictly speaking, there are no graduates; those who have successfully completed a full course might properly be considered as such, but the records of the school do not disclose the total number.

Upon joining the school for a period of one or more terms, pupils are required to pay an entrance fee of $10. In addition, the fees for tuition, which are the same in all departments, are as follows: First term, twelve weeks, $45; second term, twelve weeks, $45; third term, nine weeks, $35. Pupils who have paid the fees for the first two terms of any one year are entitled to free instruction for the third term of that year.

Advanced students who desire practice and criticism in drawing from the cast or model for a shorter period than a term are admitted by the month, upon the approval of the instructors, paying $25 for their first month and $20 per month thereafter.

The school awards ten scholarships at the end of every year, each entitling the holder to free tuition for the year following. Four of these are limited to advanced students, and the rest may be applied for by any regular student of the school to whom such aid is necessary. The late James William Paige bequeathed $30,000 to the trustees of the museum upon the condition that $10,000 more be raised within a limited time, which has been done, for the foundation of a scholarship to enable the pupil "who shall have been most proficient in painting" to study art in Europe for two years. This is open to both men and women, and is given to the pupil who is recommended by the managing committee of the school as most worthy to receive it. The Helen Hamblen scholarship, founded in 1898, is for young women only, and gives to the holder free tuition for a year, with $100 in addition. It may be awarded to the same person in successive years at the discretion of the committee.

The school has three departments, one in drawing and painting, one in modeling, and one in decorative design, with supplementary instruction in anatomy and perspective. Informal lectures are also given to pupils of the school upon the arts represented in the collections of the museum. In this school there is a manager and 8 instructors. Five of the instructors are graduates of the school and studied in Paris. Two graduated from the Art Students' League in New York, one also graduated from this school, and the last is a graduate of the Massachusetts Normal Art School. During the year 1899–1900 the average attendance in all departments was 159. Thirty-four were in attendance upon the department of decorative design. As previously stated, the school uses rooms in the Museum of Fine Arts, rent free, and its equipment is largely loaned by the museum. A few hundred dollars covers all expenditure for equipment. The cost of

maintaining the school for the year ending June 30, 1900, was $17,334.12, which sum was raised from fees of students and contributions of friends.

According to the statements of the school officials, the courses of instruction can not be improved except in small details, though the school could profit by having more space. In so far as the working classes have been reached by the influence of the school, their intelligence and efficiency have been increased. Many of those who studied in the department of decorative design have obtained employment in industrial lines, and the intelligence and skill resulting from their training has tended to raise the general standard of work. The training of the school has tended to promote the educational and social development of the community and in a lesser degree the industrial. It has greatly improved the taste of all, and in case of those who have gone into the industries it has resulted in obtaining for them better wages and more rapid promotion, and in all probability steadier employment. Those who have taken the courses of the school and go into industrial work are greatly preferred by employers; many of them have become house decorators, many more are designers of wall-paper, stained glass, magazine covers, etc., and can always be depended on both for technical skill and for good taste and artistic sense in their work. In all artistic lines of industry shop training in the community has been much improved as a result of the establishment of this and similar schools. The school has proven eminently satisfactory and has fully attained the principal end for which it was established, that of cultivating the taste of the masses.

ERIC PAPE SCHOOL OF ART, BOSTON, MASS.

This is primarily an art school, but also has courses in industrial design. It was established by its proprietor in 1898. Its start was due to the belief on the part of its founder that in all the art schools of the city too many old-fashioned ideas were prevailing. It is the intention of the proprietor of the school to carry out the principles of the art academies of Paris.

The student is led as much as possible in the direction of his individual taste, with a foundation of good drawing and anatomy gained from the study of the living model. There are no examinations for admittance to any of the classes. Students begin at once to draw from the nude and draped model. Advanced students are instructed in grouping and composing on canvas. Students can obtain free entrance cards to the Museum of Fine Arts, and can work in the art rooms of the Boston Public Library. The collections of Indian and other relics in the Peabody and Agassiz museums in Cambridge and the fine collection of Revolutionary relics in the old State House in Boston are easily accessible and are of special interest to those studying illustrating.

The management of the school is in the hands of its proprietor, who is also the director and head instructor. There are 3 principal instructors and 2 assistants. The head instructor studied four years in Paris under the French masters Boulanger, Lefebvre, Benjamin Constant, Doucet, Blanc, Delance, Gérôme, Delaunay, and Jean Paul Laurens. One of the regular instructors has spent seven years in Paris studying under Bouguereau, Robert-Fleury, and Lazar. The other regular instructor has made artistic anatomy the study of her life and is well known as a sculptor of exquisite vases. The following is an outline of the courses of instruction, terms, etc.:

MORNING CLASSES.

Students work in the classes every day excepting Saturdays, instruction being given twice a week. Models pose every day, 9 a. m. to 1 p. m.

Drawing and painting.—Drawing and painting from the nude model, in charcoal, oil, pastel, and water color, $15 per month. Separate classes for men and women in drawing and painting from the nude. A bronze medal and scholarship will be awarded in this class for best average during the year in drawing, or a silver medal for the best average in oil painting, if a sufficiently high standard is reached. Portrait and half figure, in charcoal, oil, pastel, and water color, $15 per month. Artistic anatomy with the nude model, in charcoal and colored chalk, $8 per month; one week every month in connection with the life classes; artistic anatomy free to all students of the life classes; $8 per month for students attending only for artistic anatomy. Composition (sketches), once each week, $5 per month; free to students who are members of any two classes; $1 per month for students who attend one class. Still-life and flower painting in charcoal, oil, water color, pastel, pen, and wash, $15 per month. Antique (if desired), $12 per month.

Decorative design (every day, morning and afternoon, with use of studios all day).—Decorative design, including the following list of studies: Designing for stained glass and decorative painting; metal work, carved wood, and mosaic; tapestry, embroideries, carpets, wall paper, and leather work; posters, book covers, initial letters, and decorative illumination of books, $15 per month. Students of stained glass and decorative painting, using models, $20, four lessons each week. Pyrogravure and wood carving, burning on wood and leather, $15 per month.

AFTERNOON CLASSES.

Students work in the classes every day excepting Saturdays, instruction being given twice a week. Costume models pose every day, 1.30 p. m.

Drawing, painting, and illustrating.—Drawing and painting from the costume model in charcoal, oil, pastel, and water color, $15 per month; portrait in charcoal, oil, pastel, and water color, $15 per month. The class in illustrating includes the following branches of study: Pen drawing (for book, magazine, and newspaper work); wash and gouache drawing; charcoal drawing; water color; pencil drawing; red chalk (sanguine); etching; chalk and crayon drawing; papier gillot (process paper); black and white oil color. Models pose every day, 1.30 p. m.; charge for tuition $15 per month. Composition (advanced class), $8 per month; free to students who attend any two classes; $2 per month for students who attend one class. The study of costumes of all ages will be included in this class. A bronze medal and a scholarship will be awarded for the finest set of compositions at the end of the year, or a silver medal for best work done in advanced composition class with the assistance of models and accessories, if a sufficiently high standard is reached.

SATURDAY MORNING CLASS.

A class in oil and water color, still life, designing, and antique (if desired), meets on Saturdays at 9 a. m. The tuition charge is $6 per month. A Saturday morning sketch class is free to all students of the school.

EVENING CLASS FOR MEN.

Life class and illustrating class combined, $8 per month. Nude and costume models, pen drawing, wash, gouache, water color, pencil drawing, red chalk (sanguine), black and white oil, charcoal drawing, etc., five evenings each week, 7 to 10 p. m. Instruction by Mr. Pape, Tuesday and Friday evenings. Artistic anatomy with the nude model, Tuesdays and Fridays, 7 p. m., $6 per month; one week every two months in connection with the life class. Artistic anatomy is free to all students of the evening life and illustrating class; $6 per month for students attending only for artistic anatomy.

Further information as to terms is contained in the following: Terms for all day in any two classes—for example, morning life and afternoon illustrating classes combined, or afternoon and evening classes—$20 per month, giving the student four lessons each week, with models (nude and costume), all day, and free instruction in composition. This amount may be reduced to $15.62½ per month by making two payments for the school year, in October and February, and is allowed only on a full year's attendance. Terms for morning classes, $15 per month, giving student two lessons each week, and terms for afternoon classes the same. This amount is reduced to $11.25 per month if two payments of $45 each are made in October and February, and is allowed only on a full year's attendance. An entrance fee of $5 is charged each student on entering the school, but half this amount is returned to the student if he remains a member of the school for more than four months. This fee is not required of students in the evening course.

Scholarships are given for drawing and painting from life, portraiture, water color, decorative design, illustrating, composition, etc., and are awarded on general yearly average and entitle the student to free instruction during the ensuing year. Money prizes and medals are also distributed.

During the first year of the school the total attendance was 62 and during the second year 105. There are no regular graduates, but pupils study in the school as long as they care to do so. The rooms for the use of the school are rented, and the equipment consists principally of costumes, draperies, bric-a-brac, etc., collected by its proprietor. Its cost can not be stated. The annual cost of maintaining the school is over $5,000, which is paid from fees of the students.

An attempt is being made to build up this school upon as high a line as possible. The courses of instruction are as good as the director is able to make them, though in course of time with greater experience they may be improved somewhat. The school is educating good

artists and a most competent class of illustrators for magazines and newspapers. Many of the students are architects and decorators and all gain much by the courses of the school. The school is undoubtedly increasing the intelligence and efficiency of its pupils, and so far as its influence reaches it is promoting industrial development. Those pupils who enter the industrial arena are undoubtedly more efficient than those whose education has not been obtained from the training of a school, and higher remuneration, steadier employment, and more rapid advancement will inevitably result from their training. Its pupils are much preferred by employers in industrial lines to those who have had no school training, and employers are almost constantly asking the director to recommend pupils to them for employment. The influence of the school training is already tending to raise the character of art work done in the shops, and in this sense, especially in the advertising line, shop training may be said to have been improved as a result of the establishment of the school.

NEW YORK SCHOOL OF ART, NEW YORK, N. Y.

The New York School of Art, formerly known as the Chase School, was organized under the present management in 1896. The original purpose of the school was to afford instruction in the fine arts, but owing to the growing interest in illustration, ornamental and decorative work, courses in industrial and applied art were added to the curriculum.

The school year is divided into two terms. The winter term opens September 10 and closes June 10, and the summer term opens on June 10 and closes on September 10. The school is open to both sexes. No examination for admission is required. All classes are limited, but pupils can join at any time, providing there are vacancies. Day and evening sessions are held. The hours for instruction are from 9 a. m. to 4.30 p. m. and from 7 to 10 p. m. The school awards 10 scholarships, 5 to men and 5 to women, at the end of every year, each entitling the holder to free tuition for the following year. The scholarships are given to those who show the best work during the year. Cash prizes are also awarded for the best studies in the different classes.

The industrial art courses include: Composition and water color, with a special view to their practical application in painting, illustrating, and designing; day and evening courses in illustration, in which practical instruction is given for newspaper and magazine work; decorative and applied design. This course is modeled on a French system, the purpose of which is to bring out, first, the pupil's artistic ability by a careful study of the principles that underlie all styles of ornamentation, historic or modern; secondly, to develop the inventive power by a study of geometrical and floral motives and composition; and, thirdly, to teach the technical requirements of designing as applied to book covers, metal work, ceramics, stained glass, wall paper,

textiles, etc. In addition to the foregoing, a complete course in architecture has been added to the curriculum. The tuition fees are as follows: Half-day classes, one month, $8; three months, $22.50; nine months, $55. Full-day classes, one month, $15; three months, $43.50; nine months, $110.

The school is managed by a director. There are 9 instructors, 3 of whom are graduates of French art schools, the training of the others being acquired in American art schools and in professional work. The number of pupils in the industrial art classes during the past year was as follows: Composition, 40; design, 35; illustration, day class 125, evening class 30. There have been about 1,000 graduates. The school building is rented. The equipment, which was provided by the director, is valued at $4,000. The school is maintained by tuition fees. The cost of maintenance is $10,000 per annum.

In the opinion of the director, the present courses of training and study are complete in every detail and require no improvement. It is thought that the graduates have been of great assistance to the various industries where their services are required. The effect upon those who have been under instruction has been beneficial. The systematic training they received in the school gives them preference with employers, and they have steady employment and are well paid. The graduates are not required to undergo a period of apprenticeship before taking up practical work. Although the school has proved quite satisfactory, it has not yet attained its ultimate object. Heretofore the instruction has been confined very largely to the fine arts. While continuing to maintain its distinction in that respect, strong efforts are being made to cultivate a taste for practical and applied art. When the new course in architecture has become well established and the pupils fitted to take up any branch of industrial art, then it may be said that the school has accomplished its purpose.

PHILADELPHIA SCHOOL OF DESIGN FOR WOMEN, PHILADELPHIA, PA.

The Philadelphia School of Design for Women was originally founded as a private institution in the year 1844, and was thus conducted until 1850, when the Franklin Institute assumed the management and opened the school to the public. In 1853 the school was incorporated and has since continued as a separate institution. First on the list of schools of design in the country, the primary intention of the founders was to give women an opportunity to gain thorough and systematic instruction in practical designing as applied to manufactures. This object has been broadened, and now includes all branches of art study which have a business value. The school combines all the advantages of a normal art and technical school of practical design. It gives historical and theoretical instruction in addition

to technical design, together with the more artistic branches which broaden the knowledge and cultivate the taste of the workers in industrial art.

The school year is divided into two terms of four months each, beginning on the 1st of October and the 1st of February. The hours for instruction are from 9 a. m. to 2 p. m. every week day except Saturday. The class rooms are open for practice until 5 p. m. Pupils can enter the classes at any time during the school year. Applicants are not admitted under the age of 13.

The courses of instruction include portrait painting, pen and ink sketching, etching, modeling, flower painting, illustrating, practical designing, and a normal course for teachers. The first year of the normal art course serves as a preparatory class for all branches taught in the school. It is so arranged that the pupils, through steady progression from simple to complex, may develop the power to represent objects faithfully, and learn their forms and aspects, while at the same time, by constant interchangeable use, they can acquire equal facility in the handling of pencil, charcoal, crayon, and brush. To enter the class in design a good drawing must be submitted. Otherwise the pupil must begin with the regular course work of the first year and be promoted to the special class in design as soon as her work shows sufficient proficiency in drawing and modeling. The courses of study include historic styles and principles of ornament, drawing from casts and flowers, conventional analysis of plants, and original designs applied to all the industrial arts. Technical methods employed in weaving textile fabrics are fully exemplified. After the pupils successfully pass the examinations in the second-year studies they are promoted to exclusively practical work in whatever branches they may desire to follow.

The tuition fee in the first-year class is $20 per term, and for succeeding years $25 per term; special classes, $25 to $35 per term.

The school is under the general management of a board of directors and a principal who selects the instructors and decides upon the courses and all educational features.

There are 8 instructors, several of whom are professional artists, and the remainder are graduates of the school who have had practical experience in making designs for manufacturers. The number of pupils in the course in design during the past year was as follows: Elementary class, 39; second-year class, 30; advanced class, 6. The number of graduates in this course is about 600.

The building occupied by the school is a three story structure containing 16 large class rooms and studios besides the art gallery and library. The library contains many valuable works on art, studies in architecture, ornamental designs, etc.

Regarding the courses of training and study, it is said "they are satisfactory, but might be amplified in detail." A larger museum of

stuffs and material for the pupils' use would be of advantage, and these things are to be provided when circumstances will warrant. Referring to the benefits resulting from the establishment of the school, it is stated that "apart from supplying trained designers, it affords opportunity to manufacturers to purchase a wider range of designs from the graduates who prefer not to engage themselves to any particular establishment." The importance and value of the work performed by the pupils is evidenced by the attitude of many prominent manufacturers who have a standing invitation to the classes to visit their mills, and have afforded every facility for the observation and study of the application of designs to industrial products. Furthermore, the school has helped to raise the level of industrial, educational, and social conditions in the community, and has been an invaluable factor in promoting the welfare of its pupils. For women, such positions as designers would be impossible to obtain without the training supplied by these schools. Where they have been employed in designing rooms or where their designs have been purchased by manufacturers, their work has been highly complimented. No graduate is required to undergo a period of apprenticeship, for they are thoroughly prepared to do practical work before leaving the school. The success of the school has a decided influence in the way of inducing better work among the regular designers. The school has proved eminently satisfactory and has fully attained the end for which it was established.

LOWELL SCHOOL OF PRACTICAL DESIGN, BOSTON, MASS.

This school was established in 1872 for the purpose of promoting industrial art in the United States. At the date of its establishment there were practically no designers of patterns for textile fabrics in the United States, and all designs were made and purchased abroad. There was no opportunity in this country of acquiring taste and skill in composition and design with reference to the industrial arts, and it was believed that a school of this kind would result not only in providing a good trade or profession for those whose tastes lay in the direction of art, but would prove to be of great advantage ultimately to the manufacturers by enabling them to get a greater variety of designs and to get them at a lower cost.

Under the influence of Mr. John A. Lowell this school was established by the Lowell Institute, for which he furnished the funds and of which he was the trustee. Mr. James Lawrence, largely interested in manufacturing in Lowell and other New England cities, had brought Mr. Charles Kastner over from France as a designer. Mr. Kastner was put in charge of the school, and has so remained to the present day. The corporation of the Massachusetts Institute of Technology, assumed the responsibility of conducting it, and has retained its management according to the purpose and general plan of the school as proposed by the trustee of the Lowell Institute.

The expenses are borne by the Lowell Institute, and tuition is free to all pupils. The school occupies a drawing room in the building of the Institute of Technology, on Garrison street.

To teach drawing is not among the objects of the school. Applicants must therefore possess a knowledge of drawing adequate to enable them advantageously to begin the work of composition and design. This implies a considerable degree of skill in free-hand drawing from nature, especially in sketching leaves, flowers, and other objects which frequently supply the motives of designs, and also in the use of the brush for drawing outlines and laying flat color. Accuracy and readiness in drawing and an eye for color are required.

COURSE OF STUDY.

Students are taught the art of making patterns for prints, ginghams, delaines, silks, laces, wall papers, book covers, carpets, oilcloths, etc. The course is of three years' duration and embraces: Technical manipulations; copying and variations of designs; original designs or composition of patterns; the making of working drawings and finishing of designs. Lessons are also given in china painting and cast drawing.

Instruction is given personally to each student over his work. Students supply their own instruments and materials, the cost of which is about $5 per year. The school is constantly provided with samples of all the novelties in textile fabrics from Paris, such as brocaded silks, ribbons, alpacas, armures, and fancy woolen goods.

There are 2 instructors, the principal—a designer who learned his profession in the workshops of France—and a woman, a graduate of this school. The number of students in the school at any one time is limited to 42.

There are no grades, but the course of instruction is planned to be of three years' duration. During the progress of this investigation those engaged on the first year's study numbered 15, those on the second year's study 13, and on the third year's 12. The first graduation was in the year 1876, and the total number of graduates up to and including the year 1900 was 252.

This school has no building or equipment of its own. The cost of maintaining it during the year 1899–1900 was $4,800, made up of the following items: Salary of principal, $2,500; rent of room, equipment, etc., $1,800; other expenses (including pay of assistant instructor), $500. The funds are all supplied by the trustee of the Lowell Institute.

Considered strictly as a school of design, the management does not consider its course of instruction capable of much improvement. It might be desirable to enlarge the scope of the school by teaching the pupils to place upon fabrics the designs made and to add courses of instruction in weaving, dyeing, and the study of materials, but there is no outlook for any attempt in these lines being made.

This school has been the means of raising up a force of native designers in this country where formerly there were none. It has

caused most of the designing of patterns for the textile fabrics manufactured in this country to be done here, while formerly the designs were all made abroad, and this has cheapened the cost of this branch of the industry and improved the character and artistic quality of the work done. These benefits have reached beyond the locality of the school, as the products of our mills are sold, not only in all portions of the United States, but practically throughout the world, and all the textile schools now existing in this country were patterned more or less after this school.

Schools of this character have resulted in a general raising of the tastes of the people, not only in regard to textile fabrics, but in a general way, and they have also tended to cheapen the cost of production of the textiles.

The business community has found in the graduates of such schools employees who could help in the development of new lines of business, such as interior decoration, art needlework, wall-paper designing, etc. This and other similar schools have certainly been instrumental in developing one industry, or more properly one occupation, new to this country, viz, designing.

They have graduated more designers than were needed to supply the demand in the designing forces of the textile factories, and the surplus have gone into other branches of industry, designing patterns for wall-paper, magazine covers, etc. Many have applied their knowledge and talent to making patterns for fancy goods, embroideries, art needlework, etc., and quite a number are now proprietors of so-called art stores, dealing in and manufacturing this class of goods.

Employers are now accustomed to come to these schools for new designers when needed. The only shop-trained men in the business were imported years ago from Europe. Most of these have died or were retired years ago, and they have been in nearly every case replaced by graduates of the schools. The only shop training at present is that received in the course of the current work in the designing rooms of the mills, etc. What effect the success of these schools has had upon this would be hard to say, and as most of the designers have been trained in the schools it is safe to say that as far as possible the same methods must be used.

In the ordinary sense there is no apprenticeship system in the designing rooms, but graduates of the schools when first taken in do not immediately work upon original designs of their own, but are kept for a period devoloping and extending the designs of the older designers.

SCHOOL OF INDUSTRIAL ART AND TECHNICAL DESIGN FOR WOMEN, NEW YORK, N. Y.

The School of Industrial Art and Technical Design for Women was established in New York City in 1881. The prospectus states that "the organization of this particular school grew out of a forceful necessity

for its existence. That the schools then existing taught the principles of design only, without regard to the practical application, and consequently the young women who graduated from such schools found great difficulty in obtaining employment or in disposing of their designs."

The chief object of this school is to give instruction in the practical application of art designs, so that when a pupil has completed the course she will be competent to do practical work which will have both an artistic and a commercial value. In addition to the regular classes, there is a department of home study and a correspondence class for those who can not conveniently attend the school.

The school is open to any young woman of good moral character upon payment of the required tuition fee. Pupils can enter the school at any time. Pupils who have not become practically familiar with drawing will be obliged to enter the elementary class. Pupils desiring to enter the advanced classes will be required to present specimens of their work—free-hand drawing—flowers from nature or conventionalized ornamental figures, scrolls, etc.

The lessons in drawing and in color have reference to their application to industrial purposes from the beginning, thus materially facilitating the ultimate object of the students. All drawings made in the school are the property of the pupil who made them, with the exception of one sheet from each set made, which is retained as the property of the school. Pupils have the privilege of disposing of all salable designs to manufacturers while still under instruction. Many pupils have been thus enabled to wholly or partly pay their expenses at the school. A commission of 10 per cent is demanded on all sales made by pupils while still under instruction in the school.

It takes two years to complete the entire course. The elementary class, together with the flower painting and simple designs (such as for calico, muslin, stained glass, etc.), occupy one year's time. The advanced classes, with advanced designs for oilcloth, linoleum, silk carpets, etc., require another year's study. The third year (if the student chooses to return) is passed in the practice and design room, where no regular instruction is given, but where orders are received and work done under the supervision of the principal.

The school year is divided into four terms of three months each. Sessions are held every day from 10 a. m. to 4 p. m. The courses of instruction include elementary and advanced work in ornamental and practical designing as applied to carpets, rugs, wall paper, oilcloth, stained glass, lace, silk, calico, book covers, etc. The charges for tuition are as follows: Elementary classes, $25 per term, or $75 for four consecutive terms; advanced classes, $30 per term, or $85 for four consecutive terms. In addition to the above, there are a number of special courses costing from $10 to $25 per term. Arrangements are also made to receive special students at a rate of $10 per month in elementary work and $15 per month in advanced work.

The school is managed by a president and a board of directors. There are 8 instructors, all of whom are graduates of the school. The number of pupils in the elementary class during the past year was 35, and in the advanced class, 10. The number of graduates is 600. The rooms occupied by the school are rented. The equipment cost about $1,000, and was provided by the president. The school is maintained by tuition fees. The cost of maintenance is $3,000 per annum.

In the opinion of the principal, the present courses of training and study need no improvement. It is said that there is hardly any branch of industry in which artistic skill and taste is a component part which has not been benefited by this class of schools. They have trained up a distinctively American class of designers, illustrators, and decorators whose talents have contributed to the development and success of many establishments, especially those engaged in the printing and textile industries. The effect upon those who have been under instruction is said to be beneficial in every respect. Many of the graduates are earning much higher wages than they could possibly command in other occupations where women are employed.

It is stated that some manufacturers do not want female designers, on account of a prejudice against women taking up the work of men. But where they are once employed they are preferred, because they are naturally of a more artistic temperament. They display more taste, are always reliable, and can do fully as good work as men. It is the opinion that the competition and employment of women in the field of design and illustration has tended to improve the work of the men. It is said that the graduates are fitted to do practical work before leaving the school, and are not required to undergo a period of apprenticeship. The school has proved satisfactory, and has attained the end for which it was established.

NEW YORK SCHOOL OF APPLIED DESIGN FOR WOMEN, NEW YORK, N. Y.

The New York School of Applied Design for Women was incorporated in 1892 under the laws of the State of New York. The purpose of the school, as stated in its catalogue, is to afford instruction to women which will enable them to earn a livelihood by the employment of their taste and manual dexterity in the application of ornamental design to manufactures and the arts. The founders of the school were very much interested in the welfare of young women, especially those who had to earn their own living, and were anxious to do something of a practical nature which would contribute toward their advancement and be of some permanent benefit to them. Prior to the establishment of this school there were very few women engaged in occupations which required a knowledge of ornamental design, and it was thought that the growing importance of this branch of industry

afforded unusual opportunity for the development and application of those refined artistic tastes and qualities peculiar to the sex.

While tuition fees are charged, the school is not conducted as a money-making institution. The main purpose is to provide adequate instruction along the lines laid down, and the charges are only such as will insure the services of first-class instructors and meet other necessary expenses of the school. Even the small expense required for a course of study is beyond the reach of many girls, and many are the devices resorted to by the more ambitious ones who, through a free scholarship, are able to secure their tuition but need money for their support while attending the school, or by those who, for lack of a scholarship, must themselves make up all or a part of the yearly fees for their study. It has always been the policy of the school that no worthy applicant should be turned away, and through the benefaction of friends and patrons it has been able to overcome this hardship, in a measure, by awarding a number of free scholarships each year. Thirty of these scholarships were awarded during the past year, a few of them being distributed as prizes to the pupils in the advanced classes. In addition to the regular class work, a series of lectures by recognized authorities on art is conducted during the year.

The art library contains many valuable books of reference and over 5,500 plates of designs and photographs, which are kept for the use of the pupils. In order that the instruction may be as practical as possible, arrangements are made whereby the pupils in the advanced classes in applied design can visit manufacturing establishments for the purpose of observation and explanation of the actual processes of manufacture, and thereby become acquainted with the mechanical requirements and difficulties which must be kept in mind when designs are being made.

No fixed period for the course of instruction is established. Each pupil is allowed to proceed as rapidly as she masters the successive steps in the course of instruction, and to pass from the elementary department to that of applied design whenever her attainments justify the promotion. The ability and industry of each pupil thus largely determine her rate of progress and the length of time during which she will be obliged to remain in the school, but the elementary department is intended to cover a year for those students who have had no previous instruction in drawing. No examinations are required for entrance in the elementary course. Students are at liberty to choose which of the advanced departments to enter after passing the required examinations. Instruction is not given in more than one department at the same time, but the special courses can be studied with any department.

Certificates are awarded after two years' instruction in any of the advanced departments (except in architecture) upon the completion of a certain amount of work, and if, in the judgment of the committee, the

certificate has been merited. Certificates are awarded in the architectural department upon completion of the three years' course of instruction, under the same conditions.

The school has four terms during the year. The hours for instruction are from 9.30 a. m. to 4.30 p. m. The tuition fee for the regular courses is $60 for the year, or at the rate of $20 per term. The fees for the special courses range from $10 to $35. The regular courses of instruction are divided into two departments, elementary and advanced, in addition to which there is a special course for those who desire to pursue particular lines of work. The elementary department includes courses in object, perspective, flower, and cast drawing, conventionalization, casting shadows (for architectural students), elementary antique (for students in illustration), and historic ornament. Examination in these subjects is required from all pupils before entering the advanced classes. The advanced department includes courses in the application of design to the manufacture of wall paper, carpets, and silks, and the application of elementary instruction to the work of an architect's draftsman and to illustrating. The special courses include book-cover designing, animal drawing for illustration, stained-glass designing, elementary water-color painting, water-color painting (de Longpré method), interior decoration, life class, and costume sketching. The school is under the general management of a board of directors. There are 15 instructors, all of whom are men and women actually employed in manufactories or offices. Two are graduates of foreign art schools, and the others obtained their training in American art schools and in practical work. There were 165 pupils in the elementary classes during the past year and 176 pupils in the advanced and special classes. The number of graduates is 2,288. The building occupied by the school is rented, and contains about 5,000 square feet of floor space. The equipment was provided by the school and is valued at $11,000. The school is maintained by tuition fees. The cost of maintenance is about $15,000 per annum.

In the opinion of the officials, the standard required in design work is so high that pupils ought to have longer preparation. The elementary course, which at present averages one year and a half, ought to be extended at least one year. This would give the pupils a better knowledge of essentials and would insure more rapid and satisfactory progress in the advanced work. It is probable that this change will soon be made. It is stated that the present building is far too small to accommodate the different classes, and that the constantly recurring needs of the school make it important and necessary that more commodious quarters and additional equipment should be procured. In order to overcome these drawbacks and place the school upon a more independent basis, an endowment fund of $50,000 has been started. This fund already amounts to nearly $10,000.

The benefits which have accrued to the industries that require the services of ornamental designers are said to be unlimited. The school is constantly receiving evidence of this fact from manufacturing establishments in all parts of the country. The general public and business community, and the working classes generally, have participated to some extent in the many benefits which have resulted from the establishment of these schools. Hundreds of things which enter into and are used in everyday life or in the ornamentation of public buildings, halls, etc., have been made possible, cheaper, and more beautiful through the efforts of the graduates of this and similar schools. From a sociological as well as artistic point of view the opportunity afforded to young women is most valuable, and the systematic training they receive is reflected in many directions. In thousands of homes the refining influence of art applied to everyday surroundings is raising the standards of taste and making life more cheerful for all. The school is unique in its facilities for training and the help it gives the pupils, and the effect upon those who have been under instruction has been most beneficial. The school aims to be practical in every sense and endeavors to procure positions for its graduates. In the last year alone 60 young women were placed in good paying positions by the school.

In addition to the regular class work the school arranges to take orders for all kinds of art designing. This work is performed by the advanced classes and the receipts are paid over to those who do the work. Pupils are also permitted to execute orders on their own account. Everything possible is done to encourage the pupils in this direction so that when they leave the school they will have a better knowledge as regards the commercial value of their work and be in a position to demand standard prices and wages. During the past year the pupils received over $4,500 for design work executed for manufacturers, and in the few years since the school was opened more than $18,000 has been earned by the pupils during their training by the sale of their designs. In common with graduates of other art schools many of the graduates start in business on their own account after leaving the school. Quite a number of former pupils were seen and in every instance they professed the greatest appreciation of the instruction they had received in the school. Their designs were bringing good returns and those who had accepted regular positions were receiving wages ranging from $12 to $25 per week.

The school has, in common with other similar schools, had an indirect influence in promoting better work, and by affording manufacturers a larger and better variety of designs has helped to improve the character of the product. While it can not be said that the graduates are preferred over shop-trained apprentices or workmen, yet their services are eagerly sought. The reason for this is that there is

always a great demand for new and original designs, and the work of the graduates has proved so meritorious that manufacturers are glad to patronize them and give them employment. It is thought that the success of this school has led to the improvement of ordinary shop training, and that the advent of young women into the field of design has had more or less influence in promoting better work among the older class of designers. The school has proved highly satisfactory. It has opened up many new avenues of lucrative and pleasing employment to young women and has placed them in a position to earn their own living. This has been the aim of the school from the beginning, and it has fully attained the end for which it was established.

NATIONAL INSTITUTE OF PRACTICAL DESIGNING FOR WOMEN, NEW YORK, N. Y.

This school was established in New York City, April 1, 1901. It is conducted for the special benefit of women who have had previous theoretical training in ornamental design, and who wish to become proficient in practical work without being obliged to enter a factory. It is stated that the need for a school of this particular kind arose from the fact that many of the schools where design is taught were deficient in producing practical designers, especially in wall papers and textiles. As its name indicates, the school was originally intended for women, but it has recently been decided to open a special class for young men also.

The school year is divided into four terms of three months each. Pupils can enter at any time, and are charged from date of entrance. The tuition fee is $100 per year. The courses of instruction include the designing of carpets, wall papers, chenille curtains, textiles, and printed silks. The work in the elementary class consists of historic ornament, conventionalization, flower painting from copy and from nature, drawing and painting of ornament from cast. In the advanced class drawing and painting of practical designs in the different branches is taken up. Courses of lectures having special reference to each branch of study are given throughout the year. There is also a home-study department for those who can not find it convenient to attend the school.

The school is under the general management of a company. There are 6 instructors, all of whom have had many years' experience in making designs for the trade. The school having but recently started, reports only 15 pupils. The rooms occupied by the school are rented. The equipment, which is owned by the company, cost about $1,000. The school is maintained by tuition fees. Thus far the cost of maintenance has averaged about $300 per month.

It is stated that the courses of training and study were specially prepared with a view to giving practical instruction in the several

branches and require no improvement. The school has not been in operation long enough to have any effect upon the industries or upon social or economic conditions in the community. The opinion is offered, however, that the industries in which designs are required have been aided to a considerable degree by the efforts of some of the older schools; and that while the success of many of the graduates of such schools has been slow, still, after acquiring a thorough knowledge of the practical application of their art, they have produced some highly creditable designs, and are now holding good paying positions in the leading establishments of the country. It is said, also, that in some cases the graduates of these schools are preferred over shop-trained designers. The reason assigned for this is that the former have had a broader course of training and show more originality in their work. It is thought that the success of our schools of design has not brought about any improvement in ordinary shop training. In some cases, especially in printed silk and textile designing, it is possible for graduates to work at their trade without undergoing a period of apprenticeship.

During the short time that this school has been in existence it has proved very satisfactory. The special purpose of the school is to overcome what is said to be the chief defect in the prevailing system of instruction, namely, lack of immediate practical results by the graduates, and to give the pupils a course of training that will enable them to make original and practical working designs before leaving the school. While some progress is being made in this direction, it is too early yet to claim that the ultimate object has been attained.

FRANKLIN INSTITUTE, PHILADELPHIA, PA.

The Franklin Institute was established in Philadelphia, March 30, 1824. The objects of the institute, as defined in the act of incorporation, are "the promotion and encouragement of manufactures and the mechanic arts." The important features of the institute are described in a brief sketch of its organization and history, a few extracts from which will give a more definite idea regarding the inception and establishment of its evening schools:

The institute was the first institution of its class to be established in the country, and though embodying in the scheme of its organization many of the features of the so-called mechanics' institutes, its scope was more broadly gauged and its working methods constructed on a higher plane. Neither the mechanics' institutes, which were devoted almost wholly to the instruction of artisans by means of lectures and classes, nor the exclusive societies of those learned in the sciences and arts, answered to the ideas and needs of the founders. In brief, an institution was wanted which should have inscribed on its corner stone, "Science with practice; practice with science." To give material form to these ideas, the institute was founded and the sentiment above quoted has been its animating spirit to the present day.

As the working features of the institute were gradually evolved the means by which its objects were to be attained eventually crystallized into the following form:

First, by the delivery of lectures on the arts and the application of science to them; second, by the formation of a library of books relating to science and the useful arts and the opening of a reading room; third, by the examination of all new inventions and discoveries by a committee of learned and honorable men; fourth, by the publication of a journal to contain essays on science and art, specifications of English and American patents, etc.; fifth, by holding exhibitions of American manufactures and awarding medals to worthy workmen; sixth, by building a hall for the meetings of the institute and the use of the members; seventh, by collecting machines, minerals, materials, etc., used in the mechanic arts; eighth, by the establishment of schools in which should be taught architecture and mechanical drawing, chemistry as applied to the arts, mechanics, and, if possible, of a high school for giving young men a liberal and practical course of education.

The lectures and library have occupied a prominent place in the scheme of the institute's work from the beginning. The object at present in the selection of lectures is to present the latest advances in the useful arts and sciences bearing thereon. The library contains 50,369 volumes, some 35,500 pamphlets, 2,800 maps and charts, and 1,222 photographs classified and catalogued. It is exclusively scientific and technical in character and is steadily increasing in number and importance. The institute in numerous ways has shown its sympathy with the efforts of those who have sought to elevate the standard of taste by the cultivation of the fine arts as applied to the industries. Thus the present Philadelphia School of Design for Women was taken in hand by the institute June 20, 1850, and conducted by its committee until it had become self-supporting. To another admirable institution, the Pennsylvania Museum and School of Industrial Art, the institute extended a helping hand and a sheltering roof during the period of its infancy.

The formation of a school for the teaching of mechanical and architectural drawing was effected in the year 1824. Encouraged by the success of this effort, the managers proceeded to establish another school in 1826, in which was to be taught all of the useful branches of English literature and the ancient and modern languages. This school was the model upon which the Central High School, shortly afterwards established by the city as a part of the public school system, was patterned. With the organization of the latter school, that of the institute was abandoned as unnecessary. The drawing school, however, has maintained an uninterrupted existence to the present time, and more recently the scope of the work has been enlarged by the formation of a school of naval architecture and a school of machine designing. For a number of years past the institute has also conducted a branch school in another part of the city in which the instruction is devoted exclusively to mechanical drawing.

The schools are open to both sexes, and the ordinary rules relating to attendance and studies are enforced. The school year begins the middle of September and ends the first week in May. Evening sessions only are held, and the hours for instruction are from 7.15 to 9.15 o'clock.

The curriculum includes two-year courses in free-hand, mechanical, and architectural drawing, and naval architecture, and a three-year course in machine designing. The latter course embraces mathematics, mechanical drawing, theoretical mechanics, strength of materials, kinematics of machinery, and machine designing.

The charges for tuition are as follows: Free-hand, mechanical, and architectural drawing, $5 per term; naval architecture, $7.50 per term; mathematics, theoretical mechanics, and strength of materials, $5 each per term.

The schools are under the general direction of the institute committee on instruction. There are 12 instructors, of whom one is the professor of mechanical engineering in the University of Pennsylvania, one is a well-known professor of naval architecture, one is the chief draftsman in a large industrial plant, and the others are actively engaged in various manufacturing establishments throughout the city. The number of pupils in the different classes during the past year was as follows: First-year drawing class, 207; second-year mechanical drawing, 84; second-year architectural drawing, 50; machine design, 68; naval architecture, 56; free-hand drawing, 25; total, 490. The instruction in the first-year class in drawing is of a general preliminary character and is intended to prepare the pupils for the second-year work in mechanical or architectural drawing.

The record of the number of graduates during the earlier years is incomplete, but it is estimated that the number of pupils that have completed the courses will reach nearly 1,500. The property devoted to school purposes is valued at $43,000. The cost of maintaining the institute and branch schools during the past year was $3,106. The schools are maintained by tuition fees, and appropriations by the institute when necessary.

In the opinion of the officials, the present courses of training and study need no improvement. It is the intention, however, to extend the scope of the school to include instruction in marine engineering, when circumstances will warrant. It is stated that the benefits resulting from the establishment of the schools are immeasurable. The institute was the pioneer in the work of establishing regular and systematic evening courses in industrial drawing, and during the many years of its existence it has, both directly and indirectly, aided in the formation and advancement of other schools of a similar character. It has turned out a class of draftsmen whose services have in many instances been invaluable to their employers. In conjunction with

the other features of the institute work, and especially during its earlier history, the schools have exerted a powerful influence toward the general improvement of all classes of citizens. Regarding the effect upon those who have been under instruction, it is said: "The young men who have been trained in the institute schools have always had steadier employment and received higher wages and more rapid promotion than those who did not have the benefit of a similar training." Some of the most noted architects, engineers, and machine builders in the country attribute a great deal of their success to the preliminary training they received in the institute drawing schools. The graduates are usually preferred over ordinary apprentices and workmen, because, having had a more systematic training, they can more readily adapt themselves to the conditions of practical work. Many of the graduates obtain good subordinate positions in drawing rooms without being required to undergo a period of apprenticeship. Referring to the success of the schools, it is said: "The leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and there is every reason for saying that the results have been highly satisfactory. While the institute has long since attained its ultimate purpose in this direction, nevertheless it is the desire of the managers that its present high standard shall not only be maintained, but that advanced courses shall be established when the revenue of the institute will permit."

MASSACHUSETTS NORMAL ART SCHOOL, BOSTON, MASS.

The legislature of Massachusetts, by an act passed May 16, 1870, made instruction in industrial and mechanical drawing obligatory in the public day schools, and required cities and towns containing more than 10,000 inhabitants to make provision for free instruction to persons over 15 years of age. It was soon found impossible to realize satisfactorily the benefits intended by this act, for want of competent teachers. To furnish a supply of teachers the legislature in 1873 provided for the establishment of a State normal art school, and this school was started in the fall of that year. Its purpose is to train teachers and supervisors of industrial art; but while the majority of its graduates do become teachers, yet so many of them make use of the special qualifications which the training of the school has given them to go into various industrial lines that some note of the school seems proper in this place. The following list shows a few of the occupations at which graduates of this school are working at the present time: Architects, artificial-flower makers, cabinet-makers, carpenters, carriage painters, carriage trimmers, chair makers, colorists (photographs), decorators (glass), decorators (house), decorators (papier-maché), designers (cloth patterns), designers (monumental), designers (wall paper), designers (wood), draftsmen, dressmakers, engineers (civil), engineers (mechanical), engravers (metal),

engravers (wood), florists, illustrators (books), illustrators (newspapers), lithographers, manufacturers (furniture), manufacturers (stained glass), marble carvers, mechanics, milliners, photographers, printers, retouchers (photographs), painters (fresco), painters (ornamental), painters (scenic), painters (sign), stonecutters, and upholsterers.

Candidates for admission must be over 16 years of age, must bring a certificate of moral character, and must present a high-school diploma or its equivalent. Entrance examinations must be passed upon the following subjects: Outline from group of models; outline ornaments from cast; light and shade from objects.

Tuition is free to students residing within the State and intending to teach drawing in the public schools. Students from other States who declare their intention to remain in the school until they graduate and after graduation to teach in the public schools of Massachusetts are admitted free; otherwise they must pay a fee of $50 per term. A fee of $5 per term for incidentals is charged. Graduates may continue their studies for one year upon invitation of the principal. There are two terms in the year, one beginning in September and one in February.

Diplomas are awarded to graduates of the several courses, and are of three kinds—a mechanical diploma, a free-hand diploma, and a teacher's diploma.

The school is under the management of the State board of education and a principal. It has 15 instructors, all of professional training.

There are six classes, outlined as follows:

CLASS A.—ELEMENTARY DRAWING.

Works required.—Geometric problems and perspective problems, instrumental; model drawing in outline; outline of group of common objects; light and shade drawing from a group of colored objects; details of human figure from cast; details of animal form from cast; details from the historic schools of ornament; botanical drawing in pencil, pen and ink, and with brush; water-color studies from the living plant and flowers; decorative rendering of the same; exercises in design.

Examinations for advancement.—Plane geometrical problems; perspective problems; drawing from objects (time sketch); historic ornament and design; theory of model drawing.

CLASS B.—DRAWING, PAINTING, COMPOSITION, ARTISTIC ANATOMY, AND ADVANCED PERSPECTIVE.

Works required.—Drawing from the antique figure and living model; anatomical details; perspective of shadows, reflection, and aerial effects; study from still life in oil or water color; composition; decorative design.

Examinations for advancement.—Time sketch from the antique; time sketch in color from still life; original decorative composition; paper on the historic schools of painting; paper on advanced perspective.

CLASS C.—CONSTRUCTIVE ARTS AND DESIGN.

Elementary course (first term).—Orthographic projection; projection of shadows; elements of machine drawing; elements of building construction; examination in each subject.

Advanced course (second term)—Works required.—Descriptive geometry: Illustrations from lectures; intersections of solids; projection of shadows. Ship drafting and model. Architecture: Design for dwelling or public building; structural details of same; monograph of architecture and ornament; drawing of buildings from measurements; two designs in accordance with a proposition. Machine drawing: Screws and their application; wheels, spur and bevel gears, cams, etc.; machine drawn from copy; machine drawn from measurements; details of same prepared for shop; shopwork, in wood and iron; forging, making, and tempering tools, etc.

Examinations for advancement.—Papers on solid geometry and shadows; examination of shopwork; examination on lectures, notes, and problems; examination in architecture: examinations in building construction; design sketches based upon a proposition; paper on subject selected for monograph.

CLASS D.—MODELING, CASTING, AND DESIGN IN THE ROUND.

Works required.—Elementary course: Ornament from the cast; study from the drawing or photograph; study from the living plant; details from the antique figure; details from animal form. Advanced course: Head from life; original design; study from the living model; figure composition. Casting: Cast from nature of fruit or foliage; cast from a piece mold, sulphur mold, and gelatine mold.

Examinations for graduation.—Time sketch in clay from ornament; time sketch in clay from the antique; time sketch in clay from life (head); design in the round; paper on sculptured ornament.

PUBLIC SCHOOL CLASS.

Pedagogy; teaching exercises; observations in the public schools; consideration of courses of study; graded illustrative work; blackboard drawing; details of supervision.

Examinations for graduation.—Pedagogy; essay on supervision; essay on illustrative work; essay on literature of art.

SPECIAL CLASS.

Special class in applied design.—Only students who have performed the work required in classes A, B, and D, or A and C, will be eligible to enter this class.

LECTURES.

Lectures.—Class lectures are given each year on the history of art, on design, anatomy, and perspective. A special course of lectures will be given during the first term by members of the faculty. All students are required to attend them.

There are three regular courses of instruction, made up of the work in two or more of the classes above described, as follows: The first course requires four years. It embraces the work of classes A and B and the elementary course of C and D, followed by a year in the public school class. The second course requires four years. It embraces the work of classes A, B, and D, with normal instruction from the teachers of those classes. The third course requires three years. It embraces the work of class A and the elementary and

advanced work of class C, with normal instruction from the teachers of those classes. Students completing the work of class A may choose one or more of the courses offered by the school.

During the school year of 1899–1900 there were in the different classes students in number as follows: Class A, 96; class B, 80; class C, 15; class D, 16; public school class, 24. There were also special students as follows: In the elementary classes C and D, 29, and in the special advanced class in design, 3. This makes a total in attendance of 263. At the end of the above-mentioned year the number of graduates from the regular courses was 534. The annual cost of maintaining the school is $24,000, paid by the State.

From sources connected with the school the following statement was obtained: The courses of training in this school can hardly be improved. They are now on a systematic basis and could be improved only in unimportant details. The school has resulted in general art teaching in the public schools and its graduates are serving as teachers of industrial and other drawing in public schools all over the country. Many of the graduates have become industrial workers and the effect of their education and training must have been beneficial to the industries in which they are engaged. This latter class, as a result of their training, have attained higher wages, more rapid promotion, and steadier employment than they could have done without it. They are much preferred by employers of this class of workmen because of their more systematic education in art matters, and their superior knowledge has had a marked effect in raising the methods of art training in such shops or industrial establishments as employ this class of labor. The school has proved eminently satisfactory and has fully attained the end for which it was established—the training of teachers of art—and has indeed gone far beyond it.

PUBLIC EVENING DRAWING SCHOOLS, BOSTON, MASS.

These schools were established under the provisions of a law passed in 1870, providing for the teaching of industrial and mechanical drawing in the public schools of cities and towns of 10,000 inhabitants or more, and are 5 in number.

Class instruction begins on the third Monday of October, and continues on Mondays, Wednesdays, and Fridays for 66 working nights. No person under 15 years of age is admitted. Students are admitted to the first year's course without examination.

The last week of the year's course or term is devoted to examinations in all the classes. Each first year student who has finished the work in his class and passed the required examinations is entitled to a first year certificate. Each second year student who has finished the work of his class and passed the required examinations is entitled to a second year diploma, and each third year student who has finished

the work of his class and passed the required examinations is entitled to a third year diploma.

There are four courses of instruction, as follows: Free-hand drawing and decorative design; instrumental drawing, including machine and architectural drawing; ship drafting; clay modeling. The total number of instructors is 27.

The work done in the different classes in these schools is entirely industrial in character, and the students, all of whom attend voluntarily, are nearly all workmen in some branch of industry. All of the material used by them is furnished by the city without charge. The average attendance in all the schools varies from 600 to 700 per year, sometimes slightly exceeding the larger number. The proportion of male to female students is about three to one.

The courses of instruction follow:

COURSE IN FREE-HAND DRAWING AND DESIGN.

First year.—The first year course in this department is required. The subjects for instruction are pictorial drawing from geometric solids and from still-life objects, from examples of historic ornament as an introduction to decorative design and the principles and practice thereof in its elementary stages, and geometric drawing as an important factor in decoration.

Second year.—The second year course is elective. The subjects for instruction are the same as those in the first year, but they are presented in a more advanced form and with the additional ones of drawing from casts of the human figure, in detail and in full, and the application of decoration to various purposes.

Third year.—The third year course is elective. The subjects chosen for instruction are similar to those presented in the second year, with this addition, that students may elect for one or more of their diploma sheets drawing from life, costume models, in place of drawing from casts of the human figure.

The details of the course in free-hand drawing follow:

The first work required in this course is called "practice work in time sketching," and is to be done entirely by free-hand methods: First, from single solids; second, from simple groups of models and objects, and third, from more elaborate groups of the same. In selecting models and objects for the above-named exercises and for all following work of this kind, the teacher chooses such as will be most useful in training the power of observation, in teaching the principles of practical perspective and facility in sketching from natural and manufactured objects such as can be presented in the class room. Throughout the above-named "practice work" as much attention is given to the expression of solidity and color values through the use of shading as seems desirable to the instructor, but some expression of this kind is required of the students before they begin their certificate sheets. All time sketches are preserved by the instructors until the close of the term, and are returned to the students at the same time as their certificate sheets. Students who have completed the work and passed the examinations of one term are entitled to enter the next year class without further examination; but all those who have not are required so to do before receiving such advancement. Each one is, however, credited with what he has accomplished, and is allowed to finish the rest at the beginning of the following term, and if this be done satisfactorily and within a reasonable time he is then advanced to the next class. Third year students who have not earned their diplomas are also allowed to complete the course at the beginning of the following term.

First year free-hand certificate sheets, required.—(Students will be allowed to use charcoal, pencil, brush, or pen for their light and shade drawings in the free-hand course.)

1. A sheet of problems in plane geometry.

2. A sheet of historic ornament (not less than three styles) to be drawn from the cast or from a flat copy to illustrate (1) radiation with repetition about a central point; (2) radiation without repetition; (3) vertical movement or growth; (4) horizontal movement or growth; (5) geometric or purely inventional construction.

3. A sheet to contain a free-hand pictorial drawing from some plant or portion thereof, together with illustrations by the student of one or more methods of representing the details of the plant conventionally for use in decorative design.

4. A sheet of drawing from models and objects to be finished in light and shade.

5. A sheet of design illustrating radiation with repetition about a central point, its construction and development to be based upon the top view of the plant previously drawn.

6. A sheet of design for a horizontal border to be based upon the side view of the same plant as above.

7. A sheet of drawing in light and shade from a group of solids. This group and all following groups of its kind can be made up of geometric solids, manufactured objects, and natural objects as the needs of the class may require, and should be used by the teacher not only for instruction in drawing, but also for teaching arrangement, composition, and the disposition of masses.

8. A sheet of drawing in light and shade from a group of solids. Time allowed for its completion, two hours (one session).

9. A sheet of design for the decoration of a given surface. This may be either geometric, inventional, or based upon some selected plant.

10. A sheet of drawing in light and shade from a group of solids.

All the designs in this course must be finished in half tint.

Second year free-hand diploma sheets, elective.—The three electives in this course are as follows:

First elective, A: Six sheets of drawing in outline and in light and shade, to consist of one drawing from a group of solids, one from a cast of historic ornament, and four drawings from casts of the human figure or some detail thereof. One of the above may be in outline only; the rest must be finished in light and shade.

Second elective, B: Six sheets of drawing. These may be all made from groups of solids (still life), from casts of the human figure or details thereof, from casts of historic ornament, or from selections from the above, as the student, with the advice and consent of the instructor, may elect.

Third elective, C: Six sheets of applied design. These may all be for surface decoration, such as walls, ceilings, fabrics, wall papers, or any painted or printed decorations, such as can be used for any desirable purpose; or they may all be for decorations in relief or intaglio, such as wood or stone carving, or for ornament in stucco or papier-maché, etc.; or, again, they may all be for objects of various kinds, such as vases, jars, urns, cups and saucers, plates, etc.; again, they may all be for wrought or hammered iron work, for jewelry, for engraved work, or work in relief done in any metal. In brief, they may be for decorative work of any kind that can be properly applied. All the designs made are to be finished in monochrome, and students will be allowed to elect such as will be of the greatest practical value to them individually.

Third year free-hand diploma sheets, elective.—The electives for this term (three in number) will be the same as those for the second year with the exception that the subjects chosen will be more advanced, and that drawing from life, costume models, may be substituted for drawing from casts of the human figure. The number of finished sheets required will be four instead of six as in the previous year. All designs must be finished in monochrome.

COURSE IN INSTRUMENTAL DRAWING.

First year.—All students are required to follow the course of instruction given in the first half of the term. The subjects are plane geometry, orthographic projections, intersections of solids, development of surfaces and isometric projections. The second half of the term is elective. The students having the choice between machine and architectural drawing are required to follow the course of instruction they may elect.

Second year.—The first half of the term is required. The subjects are advanced problems in plane geometry, intersections of solids, development of surfaces, and conic sections. The second half of the term is elective. The subjects of the two electives are machine drawing and architectural drawing.

Third year.—In this year the entire work is elective, and the subjects chosen are to be treated in a thoroughly practical way, i. e., as they would be in the office of a machine draftsman or in that of an architect.

The details of the course in instrumental drawing are:

First year.—First half of term (required): Two sheets of geometrical problems; two sheets of orthographic projections; one sheet of intersections and developments; one sheet of isometric drawing. Second half of term (elective): Elective A, machine drawing—a sheet of screws (conventional); five sheets of machinery details in elevation and section. Elective B, architectural drawing—three sheets of structural details; two sheets of plans of a building; one sheet of elevation of a building.

Second year.—First half of term (required): A sheet of advanced geometric problems; a sheet of advanced orthographic projections; a sheet of advanced intersections and developments; a sheet of conic sections. Second half of term (elective): Elective A, machine drawing—a sheet of screws; a sheet of gears; a sheet of wheels and belts; a sheet of machine drawing. Elective B, architectural drawing—a sheet of structural details; a sheet of plan of two-story building; a sheet of elevation of two-story building; a sheet of framing plan of two-story building.

Third year.—Instrumental drawing (elective): Four finished sheets are required from each student in this year's course. Elective A, machine drawing. Elective B, architectural drawing. In both the above-named electives the problems to be worked out by the students should, so far as it is possible, be elected by them, and in arranging their final examinations the instructors must be governed by the students' class work.

COURSE IN SHIP DRAFTING.

The course of instruction in this department is largely elective. In the first year the general methods used in the design and construction of various small craft are taught and illustrated. In the second year the plan, elevation, and section of a vessel is usually the problem to be worked out, each student having a different problem, according to his desire or need. In the third year more difficult problems of construction are given, to be also worked out in plan, elevation, and section, the distribution of these problems being governed partly by the choice of the students and partly by the instructor's knowledge of their ability. The whole subject is treated in a thoroughly practical manner.

MODELING IN CLAY.

First year.—Required: The number of works required from each student in this year is six, and are—ornament in low relief modeled from a flat copy; ornament in relief modeled from a cast (two works); group of objects in low relief modeled from the round; detail from cast of human figure; original design in relief or intaglio.

Second year.—Elective: Students in this year will be required to complete not less than four works. They may, with the advice of the instructor, elect the subjects of

these works, and their examinations (held on the last three nights of the term) will, as in the free-hand course, be based upon their class work.

Third year.—Elective: Students in this year will be required to complete not less than three works. Their examinations will be arranged in the same way and conducted in the same manner as those for the second-year students. A head and bust from life may be chosen as one of the electives.

PUBLIC EVENING DRAWING SCHOOL, LOWELL, MASS.

This school was first opened in 1872 and has been carried on continuously since. The need which led to the establishment of this and other similar schools in the State was the great lack of trained workmen, men with technical as well as practical knowledge, and the necessity of educating such men if the manufacturers of this country were not to depend upon foreigners. It has an 8-room building set apart for its exclusive use, and its equipment, which cost about $4,000, is thorough and complete. The cost of the building is not known, but about $40,000 would be required to replace it. The history of the school shows that it has in the past furnished the instruction and the impetus to further study which was necessary to enable its pupils to fill with credit important positions as teachers, draftsmen, architects, and designers, and it is now working more successfully than ever to the same end.

This school is managed by a special committee of three members of the city school board. The courses of instruction are as follows: Architectural drawing, machine drawing, free-hand drawing, modeling, and practical design. The average attendance in the above courses for the last school year was as follows: Architectural drawing, 50; machine drawing, 72; free-hand drawing, 64; modeling, 47; practical design, 13.

There are 20 instructors in the school; 1 artist, 3 architects, 3 graduates of the Massachusetts Normal Art School, and the training of the others is that which they have gained from the public schools as pupils and teachers therein. The cost of maintaining the school for the last school year was $4,074.50, which was paid by the city, as was also the cost of building and equipment.

The courses of instruction are believed to be practically as good as possible. The school has furnished a good supply of technically trained workmen, men who can both make and read plans. There is a constant demand for such men. The benefits resulting from the establishment of this school have been manifold. Many who have attended it are now professional men, teachers, manufacturers, etc., and many others are employees of the manufacturing companies located in Lowell. The graduates are greatly preferred by employers to merely shop-trained men, because they understand the theory of machinery, etc., and the success of the school has most decidedly led to the improvement of shop training in its locality, as its graduates

are now largely the shopowners, foremen, etc., and realize the great value of a thorough training. Higher wages, steadier employment, and more rapid promotion have undoubtedly accrued to the graduates of this school, as a result of their better preparation for work. In all the industries of this locality in which a training such as this school gives can be utilized, the school graduates can get work at their trades without going through a period of apprenticeship.

This school has been largely instrumental in developing a new industry, namely, that of manufacturing woolen and worsted machinery. Some years ago the Lowell machine shop started this industry, previously unknown in the United States, and it is universally admitted that this departure and venture would have been a failure but for the fact that it found among its employees men who had been trained in this school, and who were, on that account, able to take hold and direct the building of the new class of machinery.

The labor unions, as such, have never aided this school nor have they opposed it, but many members of the unions have attended the school.

EVENING DRAWING SCHOOL, AMERICAN STEEL AND WIRE COMPANY, WORCESTER, MASS.

This school was established in 1892 by the American Steel and Wire Company at its works in Worcester, Mass. (formerly the wire mills of Washburn & Moen), because of the fact that it had become difficult to find competent mechanics, and it was realized that something must be done to educate mechanics so that they would be better able to do their work. The school has 1 instructor, a graduate of the Massachusetts Institute of Technology, and the chief draftsman of the South Works of the above-named company in Worcester, Mass.

Courses of instruction are given in free-hand drawing, mechanical drawing, architectural drawing, and mathematics. At the time this information was obtained, in 1900, there were 35 students in attendance, all workmen in the mills of the company, and about 70 had attended the school regularly through the regular course of four years' work. The school is held in one of the buildings of the company, and its equipment, consisting principally of drawing tables, materials, etc., cost but little. The annual cost of maintaining the school is about $500, the funds being furnished by the company. Considered as a drawing school, its courses could hardly be improved. It has raised the general intelligence of those who attended, and in a number of instances has been the cause of the elevation of ordinary workmen to foremen. Labor unions have not opposed it, and most of those who attend its courses are labor-union men. Higher wages, steadier employment, and more rapid promotion have accrued to practically all who have taken the full courses in the school, and they are greatly

preferred to the general run of the workmen as being much more capable. To some extent this school has led to the improvement of ordinary shop training in this locality. No man, no matter what school training he may have had, can in this community commence work at his trade without undergoing a period of apprenticeship or a probationary period. This school has proved very satisfactory, and has fully attained the end of providing a sufficient supply of skilled mechanics for the demand and need of these works, for which purpose it was established.

WILMINGTON INSTITUTE DRAFTING SCHOOL, WILMINGTON, DEL.

This school was established in Wilmington, Del., in 1884. The primary object in organizing the school was to afford a suitable place where the apprentices who were employed in the manufacturing establishments during the day might devote their evenings to learning mechanical drawing, a knowledge of which was deemed essential in the local industries. The enthusiasm from the start, however, was such that it was found necessary to open the school to journeymen mechanics also. The need for a school of this kind was long apparent to those engaged in the industries of the city, since proper instruction could not well be given in the shops. The leading manufacturers, therefore, gladly contributed the funds necessary to establish and equip the school, and have always contributed liberally toward its support. The charge for tuition is $2 per year to apprentices and $3 to journeymen employed in local industries.

The school year opens the latter part of October, and evening sessions are held twice each week thereafter until 24 lessons have been completed. This comprises the yearly period of instruction. The full course requires three years. The first and second year courses include elementary and advanced work in mechanical drawing, and in the third year special attention is given to the requirements of the particular industry in which the students are employed, such as ship and car building, engine construction, etc.

The management is exercised by a board of directors. There are 3 instructors, all of whom have had both professional and practical training. During the past year there were 49 pupils in the first-year class, 22 in the second-year class, and 9 in the third-year class. The number of graduates, or those completing the full course, is 249. The rooms occupied by the school are provided free of cost by the Wilmington Institute Free Library Association, and the equipment, which is valued at $1,000, was donated by some of the leading manufacturers of the city. The school is maintained partly by tuition fees and the balance is contributed by local manufacturers.

Regarding the present courses of training and study, it is said that they are the result of several experiments to find something adapted to

the particular class of pupils that the school aims to reach, and are considered adequate for the purpose. So far as the benefits accruing from the establishment of this school are concerned, it is stated that the local manufacturers feel that the school has rendered valuable aid to the industries. It has helped to provide them with a better and more intelligent class of mechanics, and has exerted a strong influence toward the betterment of shop training and the general improvement of the workmen. Students other than shop apprentices and mechanics who study for the purpose of taking up mechanical drawing as a trade must also acquire a practical knowledge of shop work before they are considered proficient. Shop apprentices and mechanics who complete the full course are said to be better qualified than the ordinary workmen without similar training, and therefore are preferred by employers. The school has proved eminently satisfactory and has fully attained the end for which it was established.

INDUSTRIAL SCHOOLS IN THE SOUTH FOR THE COLORED RACE.

The industrial schools which have been established throughout the South for the education of the colored race have been of a special character because of the peculiar needs of the race and of the region. It has been generally recognized by the leaders in the educational work that the only possible avenue of development for the colored race in the South lies through agriculture and the handicrafts. This has been repeatedly insisted upon in addresses before his students and in public by Mr. Booker Washington, a disciple of the Hampton School and the president of Tuskegee Institute, one of the foremost schools in the work, and this idea has been adopted and put in practice as the foundation principle of nearly all schools for the colored race in the South. Many schools offer training in a variety of the common handicrafts and in agriculture, for boys, and in dressmaking and millinery, in all kinds of housework, and in the lighter tasks of horticulture and agriculture, for girls. The variety of courses depends to a large extent on the number of students and the resources of the institution.

The instruction in most of these schools is not confined to the ordinary subjects in such institutions, but comprehends as well careful training for character and conduct in all the relations of life, little as well as big. The dignity of labor, the nobility of service is a cardinal principle in the teaching. The expenses of attendance are small and frequently tuition can be obtained free of charge. The cost of board is very low—from $6 to $9 per month, and even this charge can in many instances be met by work in the school. For nearly all the schools do a good deal of work in the trades for themselves and for the surrounding country, and the school farm is usually made to supply the school table. This carrying on productive work at the trade while

learning the trade to pay the expenses of the schooling is a characteristic feature of these schools. Even though not necessary to pay the expenses of the pupils, a certain amount of labor is required in most of the schools.

CALHOUN COLORED SCHOOL, CALHOUN, ALA.

This institution is an academic and industrial school and was incorporated in January, 1892. The special need leading to its establishment was the lack of opportunities for education in industrial and other lines of the colored children in this part of the State (Lowndes County). The school appears to have been started largely through the efforts of two ladies, Miss Charlotte R. Thorn, now one of its principals, and Mabel W. Dillingham. An appeal sent out by them under date of August 1, 1891, setting forth their plans and needs, met with sufficient response to pay for the building of a schoolhouse, a teachers' home, the furnishing of both buildings, 10 acres of land, and the expenses of transacting the business of the school for the first year, and upon this as a foundation the school was started. In all the school work the effort is to prepare the pupils for living in Lowndes County, and the industrial work is therefore now in the nature of manual training, a part of a general education, rather than an attempt to teach trades; nevertheless its result has really been to teach quite thoroughly certain simple occupations.

The following courses of industrial training are given: Carpentry, sewing, cooking, and laundry work. The general management is in the hands of the faculty. In the opinion of the officers of the school, the courses of training, etc., are capable of being improved and are constantly improving. The aim has been to start at the foundation and advance with the people of the locality and to try to make the industrial courses fit their needs. The effect of the school has already been to improve the only industry of the locality, farming, to raise the home life and moral tone of the people, and to cause them to build better homes than they formerly did. Labor unionism being unknown in this section, the school is not affected by it in any way. All but four of the graduates are continuing their education in other institutions. None are following their trades at present, but are trying to further perfect themselves. This school has proved satisfactory and is attaining the end for which it was established.

The number of its instructors is 18, of whom 5 are instructors in industrial lines. Their training is academic, trade school, and practical in shops. The number of students during the last year was 176 and the total number of graduates 23. Many students are not graduated. The cost of the buildings and equipment was about $27,000, and the cost of maintaining the school during the last academic year was $19,000. The funds for maintaining the school are received from donations, tuitions, and fees.

STATE NORMAL SCHOOL FOR COLORED STUDENTS, MONTGOMERY, ALA.

This institution was originally established at Marion, Perry County, Ala., as the Lincoln Normal University, by an act of the legislature passed in 1873, and was organized, with two teachers, in the following year. It was the first, and for some years the only, school in the South supported by a State for the higher education of the colored race, and the need of this education was the cause of its establishment. In 1889 it was removed to Montgomery, and was reopened there under its present name. It is both a normal school for the education of practical teachers and an industrial school. Its primary purpose is, however, the education of teachers, and most of its graduates are engaged in this profession. It does, however, teach certain trades, and for this reason has been included in this report. Rules and regulations are few, and the discipline aims at developing the moral principles, improving the manners, and forming the habits of the pupils. The principles of honor and truth are appealed to as the great regulators of conduct, and everyone is trusted as long as he is found worthy. The important habits of punctuality, regularity, and precision are cultivated by the arrangements and requisitions of the school. The industrial courses are as follows: Carpentry and cabinetmaking, blacksmithing, wagon and carriage building, printing, sewing, dressmaking, fancy needlework, cooking.

The general management of the school is by the president and faculty. There are 20 instructors in all, 9 of them being for the industrial courses, whose training was obtained in some cases by courses of instruction in recognized educational institutions and in others from practical work. The total attendance of pupils for the year 1898-99 was, males, 326; females, 539; total, 865, and the number of graduates is 175. It is impossible to separate the students and the graduates in the industrial courses from these figures. The school is maintained by money appropriated by the State legislature and from fees of the students. No tuition is paid by the pupils, but an admission fee of $2 is charged upon enrollment.

Statements as follows were made by officers of the institution: "The courses of training and study could be improved by making them more thorough and increasing their number. But few of our graduates engage in business in the locality of the school, so that it can not be said that the industries of the locality have been benefited by the establishment of the school, though some who are carpenters have settled near the school, and they do good work according to modern methods. Most of the graduates go to distant homes or seek new fields in other States. The school has greatly benefited the people of the locality by raising their intelligence and promoting their educational and social development. Labor unions do not obtain here nor affect us in any

way. No effect has been produced in this locality by the school in developing new industries, reviving extinct or revolutionizing old ones. Our graduates are preferred by employers of labor because they can intelligently direct labor as well as do better work than those who have shop training only. A graduate of our school can work at his trade without having to undergo a period of apprenticeship. This is especially true of the girls. The school has proved very satisfactory, and has attained the principal end for which it was established."

SNOWHILL INDUSTRIAL INSTITUTE, SNOWHILL, ALA.

This school was established by William J. Edwards, who graduated from Tuskegee in 1893. It has already over 300 pupils and employs 12 teachers, all of them graduates of Tuskegee. Nine industries are taught, special attention being given to farming.

TUSKEGEE NORMAL AND INDUSTRIAL INSTITUTE, TUSKEGEE, ALA.

This institution, for the training of colored young men and women, was established by an act of the Alabama legislature, appropriating $2,000, in 1880. It was opened July 4, 1881, in a rented shanty church, with 30 pupils and with but 1 teacher. The special need that led to the establishment of the school was the necessity of training the colored youth, especially in industrial lines. At the time of the establishment of the school there were some institutions where young colored men and women could receive literary training, while those in which they could learn trades in addition were, and still are, but few. It is the aim of this school to supply, as far as it can, trained workers for the many communities throughout the South where men and women educated in industrial trades are needed. While the teaching is not confined to the trades and the constant aim of the management is to correlate the literary and industrial training, so that it will not be possible to secure the one without the other, yet the industrial training amounts to far more than manual training, as a number of trades are thoroughly taught.

In 1883 the legislature of Alabama increased the annual appropriation for the school to $3,000, and in 1893 the institution was incorporated under its present name. During the first session of the school the present location, consisting at that time of 100 acres, with three small buildings thereon, was paid for by Northern friends.

Additional buildings have constantly been added as friends have been found willing to provide them, and there are now forty-eight buildings belonging to the school, all except three erected by the labor of the students. It has acquired in all 2,500 acres of land, exclusive of 25,000 acres of mineral land granted by the Federal Congress, in January, 1899, for endowment purposes. Six hundred head of live

stock—horses, mules, cows, hogs, and sheep are on its various farms; and fifty vehicles—wagons, carriages, and buggies—constitute the rolling stock of the institution. One hundred and sixty-three thousand dollars received from bequests and gifts, and $125,000, the probable proceeds from the sale of the Federal land grant, will constitute a permanent endowment fund. Among the buildings are the Slater-Armstrong Memorial Trades Building, which is occupied by the trades division for young men, the Slater-Armstrong Memorial Agricultural Building, where practical agriculture is taught, and the Girls' Industrial Building, the home of the industries for girls. The total number of students enrolled during the year 1899–1900 was 1,231, of whom 872 were males and 359 were females. Of these, 148 withdrew, leaving an average attendance of 1,083, divided between the United States and foreign countries as follows: Africa, 1; United States, 1,072; West Indies, 10.

Of these students, 619 took the trade education provided by the institution during the last year. The total number of instructors is 75, all colored. Thirty-six of this number confine their teaching to the trades. Their education was obtained in collegiate institutions, technological and trade schools, and at active practical work at different trades. A large proportion of the students who have attended the institution have failed of graduation, and the actual number who have graduated is 321. Of these, 174 have received certificates of proficiency from the industrial departments of the school.

The cost of the buildings and equipment of this school can not be exactly stated, but the present valuation of the same may be placed at over $300,000. The annual cost of maintaining the institution is about $76,000. The income of the school comes from the endowment fund, appropriations by the State, donations from churches and individuals, and from fees paid by the students. In addition to its annual appropriation of $3,000, the State now allows the school $1,500 a year for the support of an agricultural experiment station, the work of which is carried on by the school's agricultural department.

Everyone applying to be received as a student is first examined and, if accepted, is registered and assigned to room, academic class, and industrial trade. Industrial trades are assigned, as nearly as possible, in accordance with the desires of the students. In so assigning a trade the student's natural ability, intelligence to grasp it, and physical ability to perform the duties required are all considered. Students are expected to enter promptly at the beginning of the session and to remain until the close. In order to enter the school the student must read and write, and understand addition, subtraction, multiplication, and division.

There are two schools maintained covering the same course—the day school and the night school. The day school is intended for those students

who pay for their board, study in the day, and have six workdays during the month—one day in each week and every other Saturday. Students are required to work on these days. No student under 14 years of age is admitted on any terms, and good moral character and a good physique are essential. The night school is designed for young men and young women who desire to educate themselves, but are too poor to pay even the small charge made in the day school. Requirements for admission to the night school are the same as the day school, except that no student is admitted who is under 16 years of age or who is physically unable to perform an adult's labor. Fully one-half of the students are obliged to attend the night school for the first one or two years, and work during the day, in order to obtain money with which to complete the course. Students who are able to attend the day school are not admitted to the night school.

There is no charge for tuition. Expenses are an entrance fee of $1.50, and board, including furnished room, laundry, lights, fuel, etc., $8 per month. Students are given an opportunity to work out $2 or $3 per month, thus leaving only $5 or $6 to be paid in cash. The rate of wages depends upon the amount of work a student can perform and the cash value of the same. Students having no previous knowledge of the trade at which they work are allowed to work out their board bill during the first six months, and as their work becomes valuable to the department their wages are increased proportionately. No student is paid more than $12 per month in excess of his board. No student (except those who work at Marshall Farm) is paid in cash for his labor; what he earns goes to his credit in the treasury, to be used for his expenses after entering the day school. Those students who work at Marshall Farm are allowed to draw $2 per month in cash. Students in other departments are, in special cases, allowed to draw on their accounts by orders for clothing, books, etc. All students are required to supply themselves with books at the beginning of the year.

The institute has adopted a uniform dress and hat, with which each girl is expected to provide herself within a reasonable length of time after entering school.

The institute has also adopted a neat, dark-blue uniform suit for the young men, which is furnished by the tailoring department at the bare cost of material and manufacture. The cost is about $8. All male students must provide themselves with this uniform and also the regulation cap, which costs $1.

The rules are as follows: Each student is required to have a Bible and must come provided with table napkins. Regular habits of rest and recreation are required. No student is allowed to leave the grounds without permission, and no young woman can leave the grounds at all unless accompanied by one of the female teachers. Male students when permitted to leave the grounds must wear the regulation cap. All

students must bathe twice a week. The use of intoxicating drinks and tobacco is forbidden, as are also dice playing and card playing. Students are not permitted, while in school, to take part in any political mass meeting or convention. Students are liable to be dropped for inability to master the studies, irregularity of attendance, or for any failure to comply with the regulations of the school after due notice. The demerit system has been adopted by the school as the principal method of discipline for misconduct, 33⅓ demerit marks constituting a "warning," and upon receiving three warnings a student is liable to suspension or expulsion, according as the executive council may determine.

All nonresident students are expected to board at the school, unless there is some good reason for a contrary arrangement. Students will not be registered for a shorter period than one month; those who leave before the end of the month are charged for a full month's board. When students desire to leave the school they are required to have their parents or guardians write directly to the principal for permission to do so. Students who sign a contract to work a specified time at some trade or other work must be released from their contract before an application for an excuse from school will be considered. Any student leaving without a written excuse will not be allowed to return, and students under contract will not only be dismissed but will forfeit whatever cash there may be to their credit in the treasury. Students must settle their accounts before leaving school.

All students must supply themselves with books at the beginning of the year. They must be paid for in cash. Students are not allowed to retain firearms in their possession. The commandant of cadets will retain and give receipts for any brought. Low or profane language will subject a student to severe discipline. Students are liable to fine, reprimand, confinement, or other punishment. Letter writing is subject to regulation, and all mail and express packages are inspected and contents noted. Wardrobes and rooms of students are subject to inspection and regulation, at all times, by proper officers. Students are required to be present at the daily devotional exercises and to attend Sabbath school and church services on Sunday.

The course of study is arranged for four years—preparatory, junior, middle, and senior; but as many of the students come with little or no preparation, the preparatory grade has been divided into three classes, A, B, and C, and the middle grade into two classes, A and B.

In the lowest class, the C preparatory, the instruction covers arithmetic as far as common fractions, grammar, geography as far as the study of the United States, reading, spelling, music, and drawing. The B and A classes continue the work in the same branches. In the junior year the pupils continue arithmetic to interest, and United States history is begun.

In the B middle class the pupils finish arithmetic and begin algebra, finish history and take up civics, and add also physiology. Those in the A grade finish algebra and begin geometry, and take up also bookkeeping, geology, physics, and chemistry.

The studies of the senior year are, in the normal course, psychology, rhetoric, English and American classics, ethics, pedagogy, and a review of the English studies of the previous year. In the trade courses the seniors take advanced chemistry, mechanical drawing, geometry, physics, and the trade work.

The agricultural and trade work is carried on in connection with the four-years' course in the academic department. Instruction and training are given in 30 trades, the special purpose being to teach those most likely to be of use throughout the South. The outline followed in the training in the agricultural and trade work is reproduced herewith:

AGRICULTURAL COURSES FOR YOUNG MEN.

First Year.—*Fall term:* English language. Live stock—includes history, development, characteristics, standard points, utility, features of resemblance and difference, adaptability to climatic conditions, lessons on judging, care, selection, and management of each of the leading breeds of horses and sheep; same with reference to cattle and hogs, instead of horses and sheep. Market gardening. Horticulture.

Winter term: Economic entomology. Practical agriculture—includes climate, management of manures, cultivation, economic division of farm work, planting, etc. Botany. Dairying. Market gardening. Live stock.

Spring term: Bacteriology and vegetable physiology. Laboratory practice. Practical agriculture—includes growth of crops, rotations, minerals in plant economy, harvesting, ensilage, irrigation, sewage, pastures, fields, observations, etc. English. Live stock. Horticulture. Dairying. Market gardening.

Second Year.—*Fall term:* Botany, cryptogamic. Laboratory practice. Practical agriculture. Agricultural chemistry. Horticulture. Stock breeding—includes breeding as an art, heredity, atavism and reversion, laws of correlation, variation and fecundity, influence of parents and previous breeding, sex, pedigree, form, selection, period of gestation. Dairying. Seeds and grasses—include a comprehensive study in the laboratory of a large number of native, as well as introduced, forage plants, with reference to their identification, and to familiarize the student with the more common weed, seed of which form the basis of adulteration in our forage crops. Market gardening.

Winter term: Applied botany. Laboratory practice. Live stock. Botany and bacteriology. Practical agriculture. Dairying. Horticulture. Practical agriculture. Farm drainage—includes practical effect of drainage, lands needing drainage, preliminary and topographical survey, involving the different problems of drainage engineering, map drawing, calculating depths of drains and capacity of pipes, laying and preserving drains intact.

Spring term: Bacteriology of milk. Practical agriculture. Agricultural chemistry. Laboratory practice. Horticulture. Vegetable pathology. Dairying. Animal nutrition. Market gardening. Live stock.

AGRICULTURAL COURSES FOR YOUNG WOMEN.

First Year.—*Fall term:* Dairying: The home dairy is first taken up and a clear knowledge of the following points obtained: Kind, use, and care of utensils, gravity

creaming. A study of stone, wooden, and tin churns, ripening of cream, churning, working and salting butter, preparation and marketing of same. Feeding and care of dairy cows.

Poultry raising: A working knowledge of the following points is here required: The economic value of poultry on the farm, pure and mixed breeds, plain poultry-house construction, making of yards, nests, and runs.

Horticulture: Instruction is given as to the importance of an orchard and small fruits, varieties best suited, particular locality, selection and preparation of ground, setting, trimming, extermination of borers, lice, scull, etc., especial stress being laid upon the quality and quantity of peaches, pears, apples, plums, figs, grapes, and strawberries that should be planted in a home orchard.

Floriculture and landscape gardening: A study of our common dooryards, the laying out and beautifying of same, etc., is required. The kinds, care, and use of tools used in floriculture and landscape gardening. Trimming and shaping of beds and borders, and the general care of shrubbery and flowers. The gathering and saving of seed. Special treatment of rose bushes and shrubbery.

Market gardening: Much stress is here laid upon the management of the home garden, its value to the home, selection and preparation of ground; kinds, care, and use of tools; planting, gardening, and marketing of fall vegetables; gathering of seeds; drying pumpkins, cushaw, okra, and fruits.

Live stock: Study is limited wholly to ordinary farm animals; the number and kind needed; how, when, and what to feed; characteristics and utility of the various animals.

Winter term: Dairying: The commercial dairy is the subject of study, and the following points emphasized: Use of separators, of which the school has two leading styles; churns; feeding and care of the dairy herd; breeds of dairy cattle and their selection; butter making, packing, salting, and preparing for market.

Poultry raising: Special study of breeding and feeding; when, how, and what kind of eggs and the breed of fowls to set; the period of incubation; poultry bookkeeping; saving of eggs for market; an introductory study of young chickens.

Floriculture and landscape gardening: Trimming of beds and borders; mulching, tying, wrapping, and preparation of plants for the winter; winter decoration of grounds; the decorative value of native shrubbery; a study of window plants; their value in the home, halls, and public buildings; their economic value, etc.

Market gardening: The selection of grounds and making of hotbeds, cold frames, etc., planting and managing of same; the raising of winter vegetables, marketing.

Spring term: Dairying: Milking; a study of pastures, how to destroy lice and other parasites, the care of calves, the utilization of waste in the dairy; laboratory work.

Poultry raising: A more advanced study of young poultry; brooders; sanitation of the house, runs, and of all the apparatus; egg testing, moulting and its effect upon different breeds.

Horticulture: Spring planting, trimming, budding, grafting, spraying; care of grape vines; the wire and post system of supports; spring layering and cuttings.

Floriculture and landscape gardening: Renewing of beds and borders, seed sowing, special study of propagation by layers, cuttings, division of roots, bulbs, etc.; kinds and uses of fertilizers for this special season.

Market gardening: Preparation of ground, what and how to plant, special stress being laid upon the production of early vegetables for the home and market. Reproduction of plants by seeds and by division of numbers; water, and its office in plant economy.

Live stock: Includes the history, development, characteristics, standard points, utility, adaptability to climatic conditions; lessons on judging, care, selection and management of the leading breeds of horses, sheep and hogs.

SECOND YEAR.—*Fall term:* Dairying: A more comprehensive study of milk and its constituents, weeds and their harmful effects upon dairy products, general sanitation of dairy barns, the drawing of plans, etc.

Poultry raising: Insecticides, how to make, when and how much to use; diseases of fowls and their treatment. A study of foods and their adaptability to different breeds, special study of turkeys and guineas.

Horticulture: Root and stem grafting with active and dormant buds; formation of trunk and top starch and its relation to the hardiness of fruits and shrubs; botany of the orchard; entomology; bookkeeping.

Floriculture and landscape gardening: Systematic botany, bouquet making, harmony of color, form and size of flowers, laying out of private and public grounds, roads, parks, walks, and streets; entomology of the flower garden.

Market gardening: Botany of the field and garden, physical analysis of soils, and the improvement of clay and sandy soils; the depletion of plant food and its replacement by direct and indirect fertilizers; the source of carbon, nitrogen and oxygen; draining.

Live stock: How to hitch and unhitch horses, the care of vehicles and harness, how to drive, the names of common diseases and treatment of sick animals; swine for profit.

Winter term: Dairying: The weighing and recording of milk in a commercial dairy; the Babcock and other methods of testing milk; composition of cheese and its value as a food.

Poultry raising: Composition of the animal body; a special study of ducks and geese; brooders, ponds, runs, etc.; by-products and their value.

Horticulture: Forestry, botany (cryptogamic), and systematic nut culture; preservation of timber; the economic value of different woods; the relation of forests to climate, water supply, floods, and erosion.

Floriculture and landscape gardening: A more advanced study in the harmony of arrangement, planting, etc.; plain designing, with native material only, special stress being laid upon decorations most suitable for funerals, carnivals, the making of bouquets for same, and all kinds of public and private gatherings; bee culture; preparation of hives for the winter, feeding, etc.

Market gardening: A study of the life history of insects; injuries to stored grain, pease, beans, meal, flour, dried fruits; botany of the greenhouse, cold frame, and hotbeds; the use of thermometers; a study of markets; library work.

Spring term: Dairying: Cottage and Cheddar cheese making; scoring of butter; bacteriology of milk, butter, and cheese; judging of dairy animals by the score-card method; diseases of cows and their treatment; analysis of food stuffs.

Poultry raising: Physical and chemical study of foods, library work, fancy breeds, what and how to exhibit, the history and development of the industry, heredity and the effects of inbreeding.

Horticulture: Origin of new varieties by cross fertilization; hybrids, sports, atavisms, and reversion; correlation between plants and animals; rejuvenating by pruning, grafting, and scraping the bark; special diseases of both trees and fruit and their treatment; knot growth, blight, gum excrescences, and frost injuries; drying, preserving, making fruit sirups, etc.

Floriculture and landscape gardening: Special designing in cultivated flowers, origin of new species; bees and their relation to the forest and garden; the hiving of bees and after management; a study of honey-producing plants; the economic value of the honey.

Market gardening: Relation of crops, geology of the garden, agricultural chemistry, good roads and their relation to the success and value of the farm, mineralogy, and useful birds and insects.

DAIRYING.

First year.—Aside from the scientific work in the dairy, each student is required to master the following points: The cleaning and ventilating of dairy barns, six weeks; grooming and bedding of cows, milking and recording the same, six weeks; feeding and care of both cows and calves, eight weeks; destruction of ticks, lice, etc., eight weeks; pasturing, six weeks.

Second year.—Individual study of different breeds in the dairy herd, eight weeks; breeding and feeding, eight weeks; treatment when sick, four weeks; special study of cooked and uncooked foods, eight weeks; dairy possibilities of the State, six weeks; dairy barns and cooperative dairies.

MARKET GARDENING.

Special stress is laid upon this important line of work.

First year.—Kinds and care of tools, plowing, spading, and preparation of seed beds, six weeks; construction and care of hotbeds, six weeks; planting and transplanting, twenty weeks; intensive cultivation, eight weeks.

Second year.—Growing vegetables in winter, twenty weeks; care and preparation of vegetables for market, twelve weeks; preservation of root crops and cold storage, eight weeks.

PRACTICAL AGRICULTURE.

In connection with the sciences relative to agriculture, the student must master the following points, under a competent instructor:

Kinds, care, and uses of tools and instruments, ten weeks; preparation of sandy, loamy, clayey, and peaty soils, five weeks; testing seeds, time and depth of planting, six weeks; transplanting by hand and other methods, cultivation, six weeks; destruction of insects and fungus, diseases, use of improved machinery; fence building, harvesting, housing and rotation of crops, five weeks.

STOCK RAISING.

First year.—Practical instruction will be given along the following lines: (See Live stock, fall term, first year of agricultural courses for young men) twelve weeks; feeding, breeding, grooming, and treatment while sick, sixteen weeks; harness, kinds, care, and use, eight weeks.

Second year.—Instruction in stock breeding, sixteen weeks; vehicles, kinds, care, and use, eight weeks; butchering, twelve weeks, which includes a study of beef, mutton, and pork breeds especially adapted to the South; cutting and preparing for market.

BEE CULTURE.

Bee culture has been begun with marked success, and it is hoped it will soon prove profitable as well as instructive. The climate of Alabama is very favorable for this industry. An apiary of nearly one hundred colonies has already been collected.

HORTICULTURE.

All students of the agricultural department are required to acquaint themselves thoroughly upon the following points:

First year.—Kinds, care, and uses of tools, six weeks. The importance of fruit culture, six weeks. Special attention is given to the following fruits: Apples, pears, quinces, figs, grapes, plums, peaches, cherries, strawberries, gooseberries, blackberries, etc., fourteen weeks. Deciduous, evergreen, and ornamental trees, and their importance. Special attention is given to the decorative value of native shrubbery, fourteen weeks.

SECOND YEAR.—Laying off parks and private grounds, walks, and streets, and pruning, twelve weeks. Landscape gardening and forestry, twelve weeks. Budding, grafting, layering, inarching, cross fertilization, hybrids, sports, and special direction for growing decorative plants, etc., sixteen weeks. Library work includes the classification of a library, the making of digests and abstracts from important books, bulletins, and papers.

FREE-HAND DRAWING.

Free-hand drawing is conducted under the direction of the academic department, and is designed to prepare students for work in architectural and mechanical drawing. The course in free-hand drawing is as follows:

FIRST YEAR.—Color in detail. Type forms in detail. Wholes; molding. Parts and relations. Expression by drawing. Dictation exercises. Geometric figures representing surfaces. Drill in molding, dissections, and practical drawing. Arrangement. Copies of historical frets. Original work. Repetition and alteration illustrated.

SECOND YEAR.—Color work continued. Type forms in detail, with definitions. Teach construction, by drawing, by oral or written speech. Wholes with similar objects. Drill work in sketching; free use of pencil. Parts and relations of surfaces, edges, etc. Drill and practical work. Arrangement.

THIRD YEAR.—Advanced work. Subjects taken: Measurement; judging distances; geometry; type solids in detail; projection; foreshortening; development; shapes of faces; combinations of faces; model and object drawing; illustrated sketching; effect of distance; pictorial drawing; foreshortening and convergence; color; historic ornament; frets and borders; modified bilateral units; conventionalization of plant forms; structural botany; sketching; drawing of plant forms, leaves a specialty; application of all with practical work.

CARPENTRY.

The carpenter shop at present adjoins the sawmill, but is soon to be moved into the Trades Building. It is a one-story frame building, 90 by 43 feet. The motor power for the machinery is furnished by one 40-horsepower engine. This department is divided into two divisions—one for carpentry, the other for woodworking machinery. The equipment of the carpenter shop consists of 14 workbenches, 32 inches high, 10 feet long, and 3 feet wide. Each bench has on either side three locked drawers and one closet for tools and unfinished work.

The apprentice is supplied with tools as follows: One jack plane, 1 fore plane, 1 smoothing plane, 1 hammer, 1 hatchet, 1 screw-driver, 1 nail set, 1 brace, 1 handsaw, 1 framing square, 1 try-square, 1 gauge, 1 level, 1 pocket rule, 1 draw knife, 1 pair of dividers. A tool room, located in one corner of the building, is supplied with a good variety of tools, adapted to every possible need of a woodworking establishment. The tools are bits, block planes, jointers, bevels, adzes, chisels, rasps, files, clamps, oilstones, oil cans, ripsaws, gauges, plumb bobs, hand screws, spokeshaves, etc.

In the department of woodworking machinery there are 1 handsaw, complete with wrenches and brazing apparatus; 1 automatic setting machine, with five-vise and wheel; 1 friezing or shaping machine, with friction foot reverse; 1 improved saw bench, with adjustable fence; 1 double-end wood lathe, with sockets; single and double trees; centers, face plate, screw check, floor stand and adjustable stand, etc., 1 8-inch, double lathe complete with stones, and a small combination woodworker, complete.

The following course is laid out to suit those who have six practice days in each week:

FIRST YEAR.—Names and uses of tools, sharpening and setting for use; working out pieces of timber to various gauges and lengths, straightening, squaring, beveling;

forming angles by halving pieces together, as applied in framing; plain dovetailing, as applied in framing; sketching and making plain brackets; lectures on general topics; study and construction of the 16 problems in carpentry, from 1 to 5, inclusive; observation lessons.

SECOND YEAR.—Framing; inspection of brickwork; straightening, squaring, and plumbing; bracing, tying, and bridging; sizing studs, joists, etc.; formation of cornices; setting window frames; shingling and flooring; rafter cutting; weatherboarding and boxing; lectures and supplementary studies; study of the 16 problems in carpentry, from 6 to 11; selection of building sites and examination of building soils, etc. The course of study for woodworking machinery begins during the second year, as follows: First quarter—names of machines, their uses, and how to use attachments; how to set up and regulate speed of machines and the care of same; brazing apparatus, the use and care of it; names of edged tools used with the machine, how to sharpen and use same; review. Second quarter—practical work on each machine, from blackboard designs or sketches made by instructor; wood turning to fifth exercise in Golden's Laboratory Course in Wood Turning. At the end of the second quarter all apprentices must submit to the director for inspection at least three samples of work done on each machine. Third quarter—complete to exercise 13 in Golden's Laboratory Course in Wood Turning; practical work on all machines. All work executed this quarter must be from blue prints. At the end of third quarter all apprentices must submit to the director samples of work executed on each machine with blue print attached.

THIRD YEAR.—Stair building—rises, treads, making patterns for stairs, hand railings; hints in wood carving and application in cabinet making; drawing brackets from original and selected designs; furniture making; care and use of machinery; how to set a machine and regulate the speed thereof; how to sharpen bits, etc.; bill of lumber, estimates; lectures and supplementary studies; the 16 problems in carpentry completed; lessons in making out bills of material of various kinds used by carpenters.

CARPENTRY—REPAIR SHOP.

The division of carpentry has been so crowded during the last few years that it has not been able to meet the needs of the school in the matter of keeping up repairs, etc. For this reason an auxiliary department has been organized. This division follows a course of study similar to that of the division of carpentry, and besides does all the repair work on the grounds. Course, three years, as follows:

FIRST YEAR.—Names and uses of tools; working out pieces of timber to various gauges and lengths; straightening, squaring, and boring; forming angles by halving pieces together, as applied to framing; chamfering, using chisel; mortising and tenoning; planing a 2 by 4 out of wind to gauge and squares.

SECOND YEAR.—Trimming; inspection of brickwork; straightening and squaring a building; bracing, tying, and bridging; sizing studs, joists, etc.; cornices; setting door frames and window frames; hanging doors; shingling, flashing; weatherboarding and boxing; hanging windows with weights; putting in windows without weights; putting on locks, mortise and rim knob; making a frame of a given size; miter joints; making a box or frame of a given size, using miter joints; a dovetail joint with several tongues; a half dovetail joint; a dovetail joint with miter; a blind dovetail joint; care and use of machinery; how to set a machine and regulate its speed; how to adjust the different parts; how to sharpen bits; filing both rip and crosscut saws; bills of lumber, estimates, specifications, and contracts.

THIRD YEAR.—Stair building—rises and treads, hand railing, making patterns for stairs; a blind mortise and tenon joint; a blind mortise and tenon joint at the

end of a brace; a miter joint with an open mortise and tenon; a miter joint fastened by glue tongues; a half-blind dowel joint; a dowel joint; a blind dowel joint; a blind dowel joint with a miter; a double joint with a post; a half dovetail joint; a dovetail joint with a single tongue.

BLACKSMITHING.

The blacksmith shop is located in a room 37 by 60 feet on the first floor of the Trades Building. It is well lighted, and large enough to meet the growing needs of this division. It is furnished with nine stationary forges, with Champion blowers, and an exhaust fan to give proper ventilation. Near each forge is an anvil weighing 120 pounds, and a tool bench 2 feet high, 2½ feet wide, and 6 feet long, furnished with drawers and a blacksmith's vise. Each bench is supplied with the following tools: One sledge hammer; 2 hand hammers; 8 round, iron bottom swages, varying from one-fourth to 1 inch; 1 set collar swages; 12 pairs tongs, suitable for handling iron, varying in diameter from one-half to 1 inch; 4 hand punches, varying from one-fourth to 1 inch.

In this room is the instructor's office and a tool room, where a variety of extra tools are kept and supplied to each pupil when needed to complete a job. In the shop, ironing of carriages, buggies, wagons, carts, drays, and wheelbarrows is done, besides the making of all kinds of tools and the shoeing of horses. The course of study follows:

First year.—*First term:* Cleaning the shop; making fires; names of tools and their uses; care of tools and their places; the importance of keeping water and coal in the troughs, also economy; striking; the different sizes of drills and how to run a drill press; the different sizes of stocks and dies, also how to cut threads; how to keep shop in order. Compositions are written on these subjects monthly.

Second term: The use of the hand hammer and tongs. The figures on the rule and measurements. The different sizes of iron; the formation of iron and steel; the different kinds and grades of iron and steel; welding iron, also the different kinds of welds, viz, plain, jump, dovetail, and also long and short laps and their effect, and scarifying; the use of sand; practice in making lap links, lap rings, staples, hasps, S-hooks, gate hooks, hame hooks, and round rings; resetting tires and the use of the traveler. Compositions are written on these subjects monthly; also monthly examinations are given in all work.

Third term: The use of welding compound; welding steel, viz, spring, tire, axle, and tool; how to get the measurements on jobs without the bed; welding and setting axles; measurement of the track of axles; welding and setting tires, also dish of new wheels; making clips, nuts, brace ends, also welding braces the proper length; putting work together; bench work, viz, filing, clipping, jointing, and fancy work; the effect of sand and emery paper on finished work. Compositions are written on these subjects monthly.

Second year.—*First term:* Horseshoeing; the condition of a shoeing floor; how to make a shoer's fire; the names and uses of shoeing tools; what and how to make a mold, also how to strike on a shoe; the names and sizes of shoes and nails, also the different kinds of shoes; how to file a shoe, also how to pull off a shoe, trim a foot, and clinch a shoe; the different parts of a foot and how to drive a nail; the different kinds of shoes that are used for horses with different ways of traveling. There are special lessons given in fitting, viz, different ways of traveling and different shaped feet. Compositions are written on these subjects monthly.

Second term: Wagon work, such as farm wagons, express wagons, and platform wagons; dash and rail work, and the different kinds and names; fender work; making different kinds of tools, also tempering; work from drawing; repairing different parts of buggies; estimating and cost of different things and jobs; hanging and trimming up of jobs. Compositions are written monthly on each subject.

Third term: Buggy-gear work; body and hoop work; practice in truck and carriage forging; different kinds of traps and their names. Talks on general work are given each day. Repair work of an advanced order is done by the students while this course is being taught.

PRINTING.

This is one of the most important divisions on the grounds. The printing office is located in one of the front rooms of the Trades Building, in a room 37 by 56 feet, on the first floor. It is well equipped to meet the demands made upon it, and contains one large two-revolution Campbell steam press and four job presses run by steam, one large 30-inch paper cutter, 150 fonts of job type, 600 pounds of newspaper and book type, and all necessary apparatus for a large printing office. A weekly newspaper and a monthly newspaper for the institution, besides two others for outside institutions, minutes, books, and all the pamphlets and other matter of the school are printed by the students of this division. The course is three years, as follows:

First year.—Care of office, presses, and treatment of rollers; learning type names, point system, and the tools of the trade; learning the technical terms employed in the trade; signs and proof marks, and the lay of the case; manuscript reading, punctuation, capitalization, and construction of sentences.

Second year.—Care of presses, learning to make ready and to run a platen press; learning to regulate impression, distribution of color, care of ink, and mixing colors; learning names and sizes of paper, and use of the paper cutter.

Third year.—Composition, care being taken in teaching the importance of even spacing, careful justification, accurate punctuation, and uniform capitalization; measuring type, casting off copy, and imposition; making up and locking forms; making ready on cylinder press—overlays and underlays; making out orders; rendering estimates and writing essays on subjects relative to the trade; lectures on color printing, journalism, the progress of the printer's art, and allied subjects.

The instruction in this course embraces all kinds of general mercantile, newspaper, and book printing, such as billheads, note heads, statements, letter heads, business and visiting cards, dodgers, circulars, blank forms, tabular work, and book printing. The appearance of each job is given careful and critical attention, and the principles that apply to good display are fully explained in each piece of work.

To enter this division students must be able to read manuscript, spell, and have a fair knowledge of punctuation. At the end of the course students are competent to take charge of an office and do work in type, job setting, presswork, and other kindred branches of the art. Forty-five minutes are given each afternoon, from 4.45 to 5.30, during which time the students are given theoretical training.

WHEELWRIGHTING.

The division of wheelwrighting is situated on the first floor of the Trades Building. It is fitted for work in general wheelwrighting and trimming. In this shop are located eight woodworkers' benches, 32 inches high, 42 inches wide, and 8 feet long. Each bench is divided into two divisions with a vertical board, making it possible for two persons to work at the same bench without interference. These benches have three drawers and one closet on each side, in which the tools used by the students are kept.

Each pupil is provided with the following tools: One coachmaker's vise, 4½ inches in jaw, one 26-inch No. 9 saw, one 12-inch back saw, one fore plane, one jack plane, one smoothing plane, one set chisels, varying from one-fourth to three-fourths of an inch, one ratchet brace, one set auger bits, one set gimlet bits, one coachmaker's drawing knife, one spokeshave, one marking gauge, one try-square, one bevel square, etc. Other tools are kept in reserve by the instructor and used only when needed.

This division is turning out first-class work in the line of wagons, drays, horse and hand carts, wheelbarrows, buggies, road carts, and the trimming of old vehicles.

First year.—Care of tools. Elementary with saw, plane, drawing knife, chisel, and spokeshave. Kinds of joints, splices, mortises, tenons, miters. Kinds of wood used; how to select.

Second year.—Pattern making; working by patterns. Making wheelbarrows, carts, trucks, and wheels. Construction of wagons, carts, and drays. Sketching work. During the second year instruction in wood turning is given, as follows: Names of machines, their uses, and how to use attachments; how to set up and regulate speed of machine and the care of same; brazing apparatus, the use and care of it; names of edged tools used with the machine; how to sharpen and use same; practical work on each machine from blackboard design or sketches made by instructor; wood turning to exercise 13 in Golden's Laboratory Course in Wood Turning; practical work on all machines. All work executed the third quarter must be from blue prints.

Third year.—Practice in building wheels continued. Copying with dimensions into notebooks, and working from copy continued. Building buggies, bodies, and gears. Construction of buggies and phaetons.

HARNESS MAKING AND CARRIAGE TRIMMING.

All of the harness used by the school and a large quantity sold to the public are made in this shop. All of the carriages and buggies turned out by the blacksmithing and wheelwrighting divisions are trimmed by students taking the course in carriage trimming. The course of study for both these divisions follows:

Harness making.

First year.—Care of shop; names and care of tools; thread making and practice stitching; quality and preparation of leather; names and dimensions of straps; repairing all grades of harness; cleaning and oiling harness, making odd parts of harness, such as hame straps, shaft tugs, bridle fronts, side straps, crupper docks, girths, etc.; fitting and finishing up harness.

Second year.—Review of work of first year; names and grades of trimmings; names and grades of leather; economical cutting of leather; care of patent leather; stitching of patent leather; cutting patterns; making fancy harness, such as coach, buggy, and truck, and all grades of express harness; review of work done in first and second years; finishing work; making all grades of cart and gig saddles; inspecting work done in shop and criticising all work not done properly; theory class in the shop every day except Saturday from 4.45 to 5.30 p. m.

Carriage trimming.

First year.—Use of scissors and needle, basting, the use of tack hammer, material, stitching on machine.

Second year.—Drafting, pattern cutting, making cushions, repairing.

Third year.—Making cushions, continued; drafting and cutting material for buggy tops; setting and trimming. All exercises are supplemented by actual work from time to time. Inspection and correction by the instructor all of the time the students are at work. In order to keep work fresh on minds of students, lectures in the way of asking and answering questions are given daily. Students have abundant opportunities for practical work by reason of the outside work and the general work of the institution.

Theory class in the shop every day, except Saturday, from 4.45 to 5.30 p. m. The regular work students in this shop take drawing lessons on Tuesdays and Thursdays.

PAINTING.

The division of painting is located on the second floor of the Trades Building, in a large, well-lighted, and well-ventilated room. A large elevator is used to take

vehicles from the wheelwright shop on the first floor to the painting division on the second floor. A number of closets are furnished in connection with this room for the use of students in which to keep material and tools. Adjoining the paint shop is a large, well-fitted varnish room. By this department a great deal of house painting, hard oil finishing, and graining is done. Each student is furnished with a bucket and a kit of tools; overalls and aprons are furnished by the students themselves. All of the buildings on the grounds, carriages, buggies, carts, etc., as well as the furniture made in the carpentry divisions are painted by the students of this division. The course of study follows:

First year.—Cleaning shop and keeping tools in order; learning names and uses of brushes; learning names of colors; sandpapering and priming; model work, i. e., practice on old spokes, wheels, etc.; priming houses; finishing; interior work, hard oiling and staining; exterior work; estimates, wagon painting, mixing and coloring putty.

Second year.—Advanced work in interior and exterior decorating; carriage painting, furniture painting, and sign painting; mixing paints, gilding, glazing, varnishing, and striping, finishing, graining, tinware painting; advanced work in staining and hard-oil finishing; estimates.

In all the branches harmony or the correct combination of colors is the prime factor. Theory class in the shop every day except Saturdays. The regular students in the shop have drawing lessons on Tuesdays.

MACHINERY, PLUMBING, AND FOUNDING.

Students entering this department begin with practice and theory in steam and water piping; instruction is given daily on the proper manner of piping sinks, ranges, steam boilers, engines, and residences. Blue prints are used in the plans and specifiations of pipe work. Each student will have several hours each week during work time for practice in foundry work—preparing molds for castings of all kinds, making cores, drawing patterns, and cupola management. The course in machine work will then begin with work on the bench with vise tools, chipping, filing, brazing, and scraping. The laying off of work for power machines is practiced on the bench. The students are then given work on an improved back-geared and self-fed drill, and instruction is given on the grinding of the various tools used on the machine. Work in centering, reaming, facing, countersinking, and drilling to line is taken up. The use of the boring bar, also the measurements and sizes of standard United States taps, dies, and drills for same are taught on this machine. Instruction is next given on the shaper, consisting of grinding, shearing tools, and of plain, square, round, and fancy shaping with the use of the surface gauge, straightedge, bevel square, micrometer, etc. Instruction on planer work, the management of belts, the use of various planing tools, planing straight, taper, and angle cuts, the use of the boring bar and center in planer work. Instruction in lathe work begins with the feeds, speeds, and the various tools in turning straight, taper, bevel, and round work, drilling, reaming, centering, milling, grinding, and screw cutting. The use of the lathe tools, such as rests, back gears, cross feeds, boring bars, mandrels, arbors, center indicators, and micrometers will be given.

Students will have an opportunity to design and construct some tool or piece of mechanism, and experiments will be made in steam engineering, the management of steam boilers, heaters, steam pumps, etc.

Each class in the machine and engineering departments will be expected to design and construct, ready for use, some machine, pump, or engine, such as may be used in the trade during each term of their study, the drawings and specifications of the same to be submitted to the instructor in charge for approval.

Theory class in the foundry every day except Saturday from 4.45 to 5.30 p. m. The regular work students in this department take drawing lessons at this time on Mondays and Fridays.

SHOEMAKING.

This division is on the second floor of the Trades Building, in a large, well-appointed room. All the repairing of shoes for teachers and students is done in the shop, and many new pairs are made, not only for them, but for outsiders as well. During the past year there has been added to this division a full set of Goodyear machinery at a cost of $700, exclusive of cost of engine for running same. This machinery consists of one Goodyear welt or turn machine, one Goodyear lock stitcher, one welt channeler, one outsole channeler, one welt beater, one bob winder, one welt groover, and one splitter. Besides this machinery, two Wheeler & Wilson machines have been added for sewing uppers. The course of study is two years, and is as follows:

First year.—Thread making, waxing thread, and putting on bristles; names, uses, and care of tools; putting last in shoe; use of awl and bristle; stitching and sewing rips; kinds and uses of leather; patching and half soling; finishing repair work; selection of sole and patching leather; mending shoes of different styles.

Second year.—Higher grade repair work; pegging, jointing, trimming, smoothing, setting, etc.; pump shoes; preparation of sole leather, insoles, lasting shoes, rounding up out soles, pegging or nailing on the soles; heels; cleaning and polishing taps of shoes. How to measure the foot so as to make a shoe fit; pattern cutting. Theory class in the shop on Wednesdays, Thursdays, and Fridays from 4.45 to 5.30 p. m.

BRICKMASONRY AND PLASTERING.

This is one of the most useful and helpful divisions on the grounds. All the brickwork on buildings of the school is done by the students of this division under the supervision of the instructor. Plastering and repair work, both on the inside and outside of the buildings, are looked after by this division. The theory is given in the class room and practical work in the actual construction of buildings. During the past year the Slater-Armstrong Memorial Trades Building has been completed, Huntington Hall, a dormitory for girls, nearly finished, and the girls' industrial building begun. Buildings are frequently going up at Tuskegee, and there is every opportunity for the learning of a trade. The course of study is as follows:

First year.—How to mix mortar and prepare material. Spreading mortar on walls. Piers, chimneys, and sticking joints. How to calculate the draft of chimneys, prevent smoking, and make smoking ones draw. Eight-inch wall with plumb and line; chimneys, fireplaces, and flues; turn corners and build pilasters. Twelve-inch wall, same as above. Sixteen-inch wall; bats for filling and backing. Putting flues in walls without projecting. Difference in foundations.

Second year.—Turning arches; semicircle arches 8 by 12; dovetail arches 8 by 12; segmental arches 8 by 12 and 12 by 16. Turn cornices, set doors, window sills, and frames. Test of foundation and how to square and level buildings. Specifications and estimates.

Before a student can graduate from this department he must be able to lay brick at the rate of 3,000 in ten hours and to plumb, square, and level. The following instruction in plastering is given:

Lathing, making mortar, when and how to begin plastering, thickness of coats, names of tools. Scratch coats, how to put on and why. Brown coat, how to put on and why. Screeds and spots, and their object. Putting brown coat on laths; putting browning on stone or brickwork. Finish brown coat for paint or fresco. White coat, lime or sand, and lime skin. Sand finish, trowel work; white coat, sand finish, trowel work; white coat, hard finish; preparing material, applying to walls finishing angles and cornices. Turning circles on walls and white coats around them. Preparing mortar for different kinds of work. Preparing lime for white coat. Calcimine, how to make, prepare walls, and put on.

Theory class every day, except Saturday, from 4.45 to 5.30 p. m. The regular students in this department take drawing lessons at the time named above on Mondays and Fridays.

BRICKMAKING.

On one of the school farms are found beds of clay suitable for making brick. From these beds the school has been able to make enough brick to build nine substantial buildings, with others in course of erection. The bricks are made, laid, and burned by the students, thus reducing the outlay for building to the minimum of cost. The instruction in every way is practical. The latest machinery has been installed in this division, the output per day during good weather being 20,000 bricks. Last year more than 3,000,000 bricks were made.

The course is as follows: Clay: preparation, bulked or heaped, rotted, cut in pones, shaped, dressed, turned. Tools: Shovels, picks, hoes, molds, strikers, grinding wheel, and pit. Setting brick in kiln. Time of burning. Theory class at the brickyard every day except Saturday from 4.45 to 5.30 p. m.

SAWMILLING.

The sawmill for the present adjoins the carpenter shop and is located in a building 48 by 84 feet with a boiler room attached. The power to run the machinery of the sawmill is supplied by a 40-horsepower engine. It is furnished with the following machinery: One 52-inch circular saw, one No. 5 endless bed surfacer, having a dressing capacity of 10 by 12 inches, one 6 by 26 inch flooring and surfacing machine, one cut-off saw, two lathe saws; one emery stand and grindstone, one mill to grind corn, etc., for stock.

The course of study is as follows: Selection of standing trees; defects of timber trees, such as brushwood, twisted wood, splits, checks, and cracks; measuring the height of a standing tree; felling of timber and loading on log wagon; measuring logs to find their contents in board measure; power required to drive different sized circular saws; care of belts and lacing them; capacity of sawmills; filing teeth of saws and guarding their care; calculating the speed of pulleys; how to run planers; peed of different pulleys; how to sharpen planer knives; measurement of lumber; how to make out a bill of lumber.

In this department the students have an opportunity to handle such machinery as sawmill surfacer, tongue and groove planers, lathe saws, cut-off saws, mill to crush corn for feed, and other machinery.

The boys are taught how to care for and run engines; also how to fire steam boilers. They are taught the names of the different parts of the machines. Theory class at the sawmill on Mondays, Wednesdays, and Fridays from 4.45 to 5.30 p. m.

TINSMITHING.

The tin shop is located on the first floor of the Trades Building. The benches run the entire length of one side and one end of the room. Closets are provided in which to keep tools and unfinished work. Nearly every kind of tin work is done in this division, from the covering of a house to the making of pepper boxes. Apprentices have every opportunity to become first-class tinsmiths. More than 2,000 fruit cans were made in the shop last year, as well as many other useful articles.

The shop is well supplied with tools, such as folding machines, grooving machines, wiring machines, setting-down machines, large and small turning machines, large and small burring machines, double seaming machines, large and small forming machines, gutter machines, circular shears, stovepipe machines, vises, hack saws, wood folders 22 by 30 inches, soldering coppers, bench shears, snip shears, large mantels, horn stakes, hatchet stakes, candle-mold stakes, hollow punches, square

stakes, small solid punches, rivet sets, cutting nippers, roofing tongues, double seaming tongs, hand seamers, wing dividers, pliers, squares, mallets, breast-drills, fire pots, etc. The course of study extends over two years, as follows:

First year.—How to keep the shop. Names of machines and tools. How to stop holes in old tin, and how to hold soldering coppers to solder. How to turn burrs and put on spring bottom. How to turn locks on folding machines. To cut and make small cups and other small vessels such as can be cut from scraps. How to do the soldering on neat and small vessels. To do heavy repairing, such as putting in bottoms with double seams. How to make larger cups. How to make small pans. How to do important repairing.

Second year.—The difference in soldering heavy and light seams. How to make small buckets. How to make large buckets. How to make flared buckets. How to cut simple patterns. How to make large pans, such as milk pans, round cake pans, and wash pans. How to make dish pans. How to make slop cans. How to make foot tubs. How to make coffeepots. How to make pans, buckets, and cans in different shapes. The fluids used in soldering different metals. The use of square and compass. How to get the different angles. How to cut patterns of the different kinds of vessels made. How to put on tin roofs. How to make and put on conductor pipes. How to get the cost of work. How to work zinc, as in lining bathtubs and boxes.

After a student has gone through this course of study, if he is apt in learning, he can do good work. Theory class in the shop on Mondays and Tuesdays, from 4.45 to 5.30 p. m. These students take drawing lessons on Wednesdays and Thursdays.

TAILORING.

This division is located on the second floor of the Trades Building in a well-appointed room 37 by 56 feet. Two men and a woman teacher are in charge of the work. All of the uniforms for the young men students as well as suits for students and teachers are made in this division. The object is to teach the trade thoroughly, and in this much success has been achieved. Girls are permitted to enter this department and are taught tailoring under the direction of the instructor in charge and a woman teacher. Satisfactory results have been achieved and the object is to make the instruction even more helpful and valuable.

The girls in this division make all of the overalls, common pantaloons, vests, coats, etc., used by the students and industrial instructors. The course of study is as follows:

First year.—Care of shop and irons. Position on the tailor's board. Practice in the use of needle and thimble in backstitching and felling. Cleaning and repairing. Working common buttonholes. Finishing various styles of pants pockets. Common pants making. Uniform pants making.

Second year.—Review of work of first year. Stitching cord seams and finishing vest pockets. Fine pants making. Making common vests.

Third year.—Review of work done in first and second years. Making coat sleeves and finishing the different kinds of coat pockets. Fine vest making. Uniform coat making. Common citizen coat making.

Fourth year.—Review of work done in second and third years. Fine coat making. Drafting. Drafting and cutting. Harmony of colors and how to select suitable trimmings. Taking measures. Economy in cutting.

Theory class in shop every Monday and Thursday, from 4.45 to 5.30 p. m. Drawing every Wednesday, from 4.45 to 5.30 p. m.

PLAIN SEWING.

This division is at present conducted in a well-appointed room 18 by 26 feet, but is to be removed to the new girls' industrial building when it is completed. Girls who know practically nothing about needlework are admitted to this division, and

upon the completion of the course are promoted to the dressmaking division. No student, however, is allowed to enter the dressmaking division until complete satisfaction has been rendered in the plain-sewing division. The course of study is as follows:

First year.—Threading needle and use of thimble. Practice on scraps of cloth. Basting and overhanding. Turning hem by measure, hemming and running. Stitching and overcasting. Gathering, stoke gathering, and putting on bands. Sewing on buttons. Putting in gussets. Herringbone stitching on flannels. Patching, hemstitching, tucking, and whipping ruffles. Chain stitching, feather stitching, and mitering corners. French hem on damask. Darning on scrim cashmere. Slip stitching and blind stitching. Mending and darning. Making buttonholes and eyelets.

Second year.—To enter this grade the pupil must be familiar with the first year's work. The names of sewing machines and parts. How to clean, oil, and operate the machines. How and when to use attachments. Machine stitches; choice of material. Instruction in the use of national garment cutter. Cutting and making men's drawers, undershirts, and colored and white shirts. Taking measures; cutting white skirts by measure. Making skirts with or without ruffles. Cutting underwaists from pattern; basting, stitching, and trimming. Cutting and making a common dress by pattern. This course is intended for hand sewing, giving practice in all kinds of stitches on suitable material. The national garment cutting system is taught in taking measures.

Theory classes in the sewing room every day, except Mondays and Saturdays, from 4.15 to 5 p. m.

DRESSMAKING.

The dressmaking course has grown to be one of the most important of the divisions for girls. The great need at this time is for more commodious quarters, which will be supplied when the new girls' industrial building is completed. At present the division is located in a well lighted, well ventilated room 16 by 40 feet. The room is fitted with large tables for drafting, tracing, and cutting, and with sewing machines, dress forms, mirrors, books of mode, and show cases for finished work. A full line of samples of dress material is always kept on hand. The instructor in charge of the work has taken the advance courses at the Pratt Institute. The course is properly graded. Applicants must have completed the course in plain sewing or pass an examination to prove their knowledge of hand and machine sewing and their ability to make simple garments before they can be admitted to this division. In this division, as in all others, students are paid according to the value of their work. The course of study is as follows:

First year.—Choice of materials. Drafting and cutting foundation and outline skirts from measurement. Making, hanging, draping, and trimming the skirt. Talks on forms, line, and proportion in relation to draping and trimming. Drafting, cutting, and fitting plain basques, and general finish of these garments.

Second year.—Drafting basques, sleeves, and the different accessories to the basques from measurement. Drafting basques with extra seams for stout figures. Cutting and fitting close and double-breasted garments. Cutting and matching striped, plaid, and figured basques and skirts. Talks on forms, including artistic and hygienic principles of dress. Talks on color and textiles applied to dress. Advanced work in making complete dresses from different materials.

Third year.—Cutting, fitting, and pressing. Practice in the use of colors; talks on the manufacture of cloth. Drafting jackets of various styles; making various styles of collars and pockets. Lining and finishing pockets. Draping garments of every kind. Making and finishing garments of every kind from different materials.

Theory classes in the sewing room every day, except Mondays and Saturdays, from 4.15 to 5 p. m.

MILLINERY.

This division is conducted in connection with the plain-sewing division. It is the intention to have all the appointments of this room, as well as those of the other divisions, first class in every particular.

A regular fall and winter and spring opening is held each year in one of the rooms of the institution, and visitors from the town of Tuskegee, as well as others, are invited to inspect the work done by the students. A large number of hats, bonnets, etc., have been made in this division for sale.

There are two graded courses, each course covering a term of four months, as follows:

First course.—Talks on color and textiles. Instruction in choice of materials. Wiring. Folds. Binding. Fitted facing; full facing; puffed edges. Varieties of bows. Talks on the manufacture of straw and felt hats, and of ribbon. Talks on form and line. Principles applied to a hat of choice materials. Examination. Drawing: Pencil practice. Study of the appearance of cylindrical objects. Drawing untrimmed hats. Drawing drapery, bows, etc.

Second course.—Talks on color, form, and line. Plain-covered bonnets made, trimmed, and lined. Full-crowned, fancy-edged bonnets. Talks on the manufacture of crape and on the growth and manufacture of silk. Crape bonnet. Silk hat or bonnet. Shirred bonnet. Fancy toque or turban. Principles applied to a bonnet and to a toque or turban of choice materials. Drawing: Drawing trimmed hats and bonnets. Notes on form and color. Practice in the use of color.

Applicants must be over 14 years of age and must be able to do neat hand sewing. Pupils are required to complete satisfactorily the first course, or to pass an equivalent examination before entering the advanced classes.

COOKING.

The room devoted to this course is 24 by 36 feet, well lighted and ventilated. The institution insists that every girl attending the day school shall receive instruction in this department, special stress being laid upon the matter of cooking plain, ordinary food. There is need for additional facilities in this division, but the institution has been able to give those who come to it the benefit of the best instruction. The instructor in charge is a graduate of Mrs. Rorer's Philadelphia Cooking School. During the past year the principal of the Milwaukee Cooking School, Milwaukee, Wis., spent five weeks at the school conducting special classes for girls, teachers, and others. The course of study is as follows:

First year.—Fire making and fuels. Cooking utensils and their care. Measurements and their equivalents. Various modes of cooking, viz, boiling, broiling, baking, frying, etc., including the making of breads, soups, salads, simple and healthful desserts, and simple meat dishes. The preparation of gelatine, the cereals, vegetables, and fruits.

Second year.—Food, its use, classification, adulterations; manufactured foods. The composition of the human body. Noncombustible food; water and earth. Condiments and beverages. Carbonaceous foods; starch, sugar, and fats. Nitrogenous foods; milk, eggs, meat, fish, cereals, and vegetables. How to market. Digestion, absorption, assimilation, and nutrition. Preparation of food and adaptation to climate, age, occupation, and state of health. Relative nutritive and commercial value of food and its comparative digestibility. The preparation of poultry, game, fish, pastry, fancy dishes, creams, and cakes. The preparation, composition, etc., of fermented and unfermented breads. Invalid cookery. Dietaries and menus. Arrangements of table for various meals; etiquette of serving and table manners in general.

Each course comprises about thirty-five lessons. The girls of all day-school classes are given the advantage of this course, and each of these girls is expected to provide

herself with a white cap, apron, and sleeves. Besides the work laid out, each girl of these classes is required to prepare at least three papers bearing upon the course of study during the year.

LAUNDERING.

The laundry is for the present housed in a large 3-story building. The girls are taught the art of washing and ironing after improved methods. During the last school year a washer, extractor, mangle, and collar and cuff ironer were added. It is not the intention to provide the laundry with too much machinery, but rather to lighten the drudgery. Two instructors are in charge of this division. When the girls' industrial building is completed the laundry is to have its home therein. Drying rooms, ironing rooms, and every facility possible will be afforded for the best teaching. All of the laundry of unmarried teachers and students is done by this division. The course is one year, as follows:

First term: Water—kinds, hard, soft; how known, uses. Soap—definition, kinds, why used. Alkalies—kinds, vegetable, volatile, mineral, uses.

Second term: Irons—kinds, uses. Preparation for washing; collecting and assorting soiled clothes; disinfectants, why used. Washing of flannels, linens, prints, etc.; drying; ironing and folding. Miscellaneous work; laces, embroideries, silks, etc. Recipes for laundry articles, such as soap, bleaching compounds, etc. Review and examination.

Third term: Bluing—kinds, indigo, Russian, ultramarine; why used. Starch—kinds, rice, maize, pulse; how made, how to determine. Acids—kinds, uses. Preservers of color—ox gall, sugar of lead, etc. Machinery—uses and care. Care of laundry articles.

NURSE TRAINING.

The increasing demand for trained nurses in the South has necessitated the establishment of a regular training school for nurses in connection with the school hospital. A complete course of three years has been arranged for practical and theoretical work in the wards of the hospital. Two of these years are given to daily work and instruction in the hospital, the third year consists of lectures and bedside instruction, while one or two days of each week are devoted to hospital work. The hospital accommodations at present allow of only sixteen pupils receiving instruction at a time. The applications for places in this course far exceed the number which can be received. During the last year there were sixty applicants. This makes it possible for the physician in charge of the hospital and the head nurse to select for pupils only those who are of the strongest physique and who have shown some special fitness for the work. The senior students are frequently employed by the physicians of the town of Tuskegee to take charge of cases for them, and in this way they obtain experience and excellent supplementary training. The graduates of this division are already widely scattered and are doing good work. In addition to those who are employed in families, a graduate of the school is in charge of the surgical ward in the Hale Infirmary at Montgomery; another is assistant matron and head nurse in a hospital at Greenville, Miss.; another is employed at the hospital connected with the Alabama Medical University at Mobile, while still another is employed by the year in the Alabama Female College at Tuskegee.

The physician in charge, besides giving bedside instruction, delivers a regular course of lectures to the B middle, A middle, and senior classes of the day school, on elementary physiology, hygiene and anatomy, practice of medicine, including eye, throat, and nose; surgery, diseases of women, midwifery, diseases of children, diseases of the skin, practical use of the battery, etc.

The following course of instruction is given by the head nurse and resident physician:

First year.—Qualifications of a nurse. Relations of a nurse to the doctor, to the patient, to the family. Deportment in hospital and private practice. Hospital etiquette. Self-protection. Model sick room. Practical suggestions. Beds and bed-making. Methods of handling bed patients. Contagion and disinfection. Prevention of contagious diseases. Bones: Practical lessons, including names, uses, composition, fractures, dislocations, sprains, repair, diseases, and treatment. Diet lists: Practical work in diet kitchen for three months.

Second year.—Medicines; methods of administration, physiological actions. Tests and illustrations of drugs in everyday use. Apothecary weights and symbols, with practical work in the drug room. Hypodermic injection of medicine. Care of the sick. Practical lessons on heart and circulation, from manikin and patients. Process of digestion and assimilation. Intestinal tract in fevers, etc. Enemas, suppositories, and laxatives. Diet lists: Lessons and work in the diet kitchen in preparing food for the sick, at least three months. Local applications and how used. Excretory organs, examinations of urine, use of catheters, etc. Medical and surgical emergencies, including sunstroke, fainting, drowning, convulsions, heat, exhaustion, artificial respiration, and hemorrhages. Surgery and surgical nursing: preparation of patients for operation; kinds and uses of bandages; sterilization. Massage methods, including electricity.

Third year.—Operating room, obstetrical room; care. Preparation of a patient for an operation; the nurse; the doctor. Kinds of operations; instruments used and preparation of. Solutions; antiseptic and aseptic; uses and preparation. Wounds: Varieties, surgical treatment, infection, and modes of healing; burns, etc. Bandages: Making, uses, kind, application, sterilization, etc. Midwifery: Practical and theoretical instruction relating to care of patient before and after childbirth: care of both mother and child. Common diseases of women; causes and how prevented; treatment. Diseases of children; cause, prevention, and treatment.

HOUSEKEEPING.

The aim of this department is to have all the girls get some training in housekeeping. To do this the girls of the school are divided into three classes, each class taking the course in three months. By this means they get some idea of how to make a comfortable home. Following is the course of instruction:

The home: How to beautify, how to make happy; advantages of so doing. House; location, furniture; what to buy, how to buy it; proper arrangement; how to care for it. Miscellaneous articles—pictures, how to hang them; carpets, how to sweep, clean, and preserve them; shades, how to use them; brooms, how to rest them. Spring house cleaning; when to do it. How to do general weekly cleaning; care of lamps. Bedroom; where it should be; how to ventilate; how to light and heat; when and how to clean; decorations used. Beds; when and how to clean; when and how to air them; why aired; how and when to change bedding; how to keep it during the summer season. Sweeping and dusting; how to sweep and dust properly; how to build a coal fire; when and how to burn out chimneys; use of dustpan and trash box. Scrubbing; how to use the brush; advantages of use of brush; how to remove paint; how to polish window panes.

Dining room: How and why we should make it the most pleasant room in the house. The table, how to set it, what decorations to use; how to serve different courses; how to care for linen and silver; care of pantry, dishes, and towels; duties of host and hostess; how to sit at table; conversation; how to wait with ease.

Kitchen: How to furnish, care of cooking utensils; how to market, how to economize; punctuality and regularity in the preparation and serving of meals; advantage of same.

Sick room: Where it should be; how to make it attractive; ventilation, heating, and lighting; when and how to change patient's clothes; how to deal with bedding; how to feed the sick; how to visit the sick; what to talk about.

Yards and outhouses: How to keep clean; how to make yards beautiful; need of keeping the outhouses clean and pure.

Visiting: When to visit, how, whom; how to receive.

Housekeeper: Personal appearance, what to wear, how to wear it; colors suitable to different complexions.

With the exception of the first two, all of the lessons have a practical application. The theory is given one day in lectures and applied in practice the next day.

MATTRESS MAKING AND UPHOLSTERING.

For several years instruction has been given to a limited number of students in the making of ordinary mattresses and pillows, and in general upholstering, but until this year the work has not justified a separate and distinct division. Heretofore it has been conducted only for the purpose of supplying the boarding department with mattresses and pillows. During the past year an instructor has been placed in charge of it and ten girls have had instruction. The principal idea has been to provide additional indoor work for girls, so as to leave the out-of-door work as nearly as possible for young men. No young men are connected with this department as formerly. Any girl student wishing to learn mattress making and upholstering will, upon application, be given an opportunity to do so.

CANNING.

During the summer vacation the institution operates a steam canning plant for the double purpose of preserving its own stock of fruit and for teaching the industry of canning to a class of students who remain at the school during the vacation. In an average fruit year about 5,000 gallons of fruit are put up by the plant. One-gallon tin cans are used. These cans are made in the school's tin shop by the class of young men who are learning the tinsmith's trade. Most of the fruit comes from the orchards of the school.

Students wishing to receive instruction in canning are required to make early application to the director of industries to be allowed to remain at the school during the vacation.

ARCHITECTURAL AND MECHANICAL DRAWING.

The drawing room is at present situated on the second floor of the Trades Building and is a large, well-lighted room, 37 by 80 feet. It contains 30 tables, 30 by 42 inches on top and 36 inches high. Each table is provided with a drawer to hold the drawing materials used by the students. A large case, in which students' drawings are kept, is placed in the room. Near at hand is complete apparatus for making blue prints. Each student is furnished with a set of drawing instruments, board and T-square. All students in the day and night school who are in the mechanical department, and in and above the A preparatory class, are required to take instruction in this division. The course of study is as follows:

A preparatory class: Names and uses of instruments; construct plain geometrical figures; projections; explanation of scale; various scales, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$; objects drawn to scale; free-hand drawing.

Junior class: Projections; isometric drawing; working drawings; detail drawings; materials; free-hand drawing; design.

B middle class: Working drawings; detail drawing; material; construction; free-hand drawing (see course in free-hand drawing); shades and shadows; design.

A middle class: Problems in construction; strength of materials; history of architecture; estimates; specifications and contracts; design.

Senior class: Advanced problems in construction; graphical statics; perspective; historical architecture; advanced problems in design; rendering; superintending construction.

The work of the first year is largely preparatory. It begins with simple geometrical drawing, to familiarize the students with the drawing instruments and to teach them accuracy and neatness; also to give some preliminary processes which will be useful in the future work of the course. This is followed by some work in projections, which find application in scale drawings of simple objects.

Strictly speaking, the work in architectural drawing begins the second year with the study of materials and of construction in wood and brick. Considerable time is devoted to the study of the more common materials used in building, and to detail and work drawings. Special stress is laid on designing.

In the last three years a great amount of time has been given to the study of strength of materials, estimates, specifications, etc. A brief review is taken of the history of architecture, to give the student a better knowledge of building as carried on to-day.

Throughout the course students are required to spend a good deal of time in free-hand drawing, to give them skill and facility with the pencil, which are essential to good drafting.

In addition to the time spent in the drawing room, students must spend some time in the workshops, to give them a more intimate knowledge of the materials with which they deal, and to supervise work intelligently. The amount of time required depends on the knowledge the student already has of materials and construction.

The amount of building constantly in operation on the school grounds and in the vicinity gives students an excellent opportunity to study work in process of erection under the careful supervision of the heads of the different divisions and to enter competitions for buildings which are to be erected. This also allows a chance to get at just ideas of cost.

For students taking the regular course in carpentry, tinning, wheelwrighting, machinery, etc., special courses have been arranged, suited to the needs of each.

The general management is by an executive council of the faculty, acting under the general direction of the board of trustees. The funds for building, maintaining, and equipping come from contributions obtained by the personal solicitation of the president. No tuition is charged. It is stated by the officials of this institution that the courses of training and study can be improved only by extending their scope, and this is being done each year. In the section where the school is located there are but few industries, the school itself doing nearly all the industrial work for the country around it, and doing it much better than it was done in the days before the starting of the school. While many of the graduates have become teachers, yet all through the Southern States are scattered graduates of the school, who are engaged in the trades and in business, and their work is, generally speaking, of such a high order as to set the standard for work of a similar kind. As the school gives instruction not only in the academic and industrial sense, but also in ways of living, care of the home, and personal appearance, etc., the influence of its graduates upon their race in promoting social as well as industrial and educational development has been very marked all through the South. As labor unionism hardly exists in this section of the country, it has had no influence of any kind upon the school.

By the better preparation for work which those who have attended this school have obtained they have in practically all cases made more rapid progress toward success in life, and secured higher wages and steadier employment than others who have not benefited by this instruction. The graduates are preferred by employers not only to others of their race, but also in many instances to white employees, many of whom are not so well trained. So great is the demand for the graduates of the school that a regular employment bureau might well be run. Any graduate can work at his trade without serving a period of apprenticeship, as he is taught his trade in full before being allowed to graduate. While improvement is always possible, yet it can be truthfully said that the Tuskegee Institute has already attained the end for which it was established, namely, the improvement of the race, intellectually, socially, and morally.

MOUNT MEIGS COLORED INDUSTRIAL INSTITUTE, WAUGH, ALA.

This institution for the education of the colored youth was established in 1885 by Miss Cornelia Bowen, a graduate of Tuskegee Normal and Industrial Institute. This school has four buildings, including one devoted to industrial training. There are 5 teachers and an average attendance of 200 pupils.

BOYLAN INDUSTRIAL HOME AND SCHOOL, JACKSONVILLE, FLA.

The need of missionary work among the colored girls and of a training which would fit them to be self-supporting led to the establishment of this school. It was opened at Jacksonville, Fla., in April, 1886, in a small cottage of 6 rooms with a class of 5 girls. The work now (school year of 1900–1901), in its different departments, occupies 3 buildings and the growth of the school has been continuous.

Sound health, good character, and the desire for improvement are required for admission. Christian instruction is the basis of all plans of work in the school. Present accommodations provide for a family of 36 boarding students. Terms are as follows: Board, $6 per month; incidental fee, $1; tuition, day pupils, 75 cents per month; tuition, primary department, 50 cents per month; industrial fee for day pupils, 25 cents; music, three months, 12 lessons, $3; use of instrument for practice, $1.50; dressmaking, one term of three months, $3; millinery, one term of three months, $2. Opportunity for a few of the students to earn a part of their expenses is provided each year.

The general management is in the hands of the superintendent and teachers under the direction of the Woman's Home Missionary Society of the Methodist Episcopal Church. There are 9 teachers in the institution, graduates of various colleges and normal schools, and 5 of these are engaged in industrial work.

The course of study includes all branches taught in grammar-school grades, together with a practical knowledge of housekeeping and sewing. Music, instrumental and vocal, is taught, and there is a course of instruction in Bible study. In addition to the industrial instruction in sewing and housework given to all the students there is a trade class in dressmaking and millinery. During the school year of 1900–1901 there were 50 in the dressmaking course, 3 in the millinery course, and 24 in cooking. From the industrial or trade class there have been 8 graduates. The buildings and equipment cost about $18,000, and the annual outlay for maintaining the school is $3,000. Tuition and other fees pay about two-thirds of the annual expenses and the balance of the necessary funds are donated by the Woman's Home Missionary Society of the Methodist Episcopal Church.

With better facilities it is believed by the superintendent that the courses could be improved, and it is hoped that soon the school will have a trades building in which the industrial work can be extended and close attention be paid to details.

FLORIDA BAPTIST ACADEMY, JACKSONVILLE, FLA.

This academy began its work in the spring of 1892. It is controlled by the colored Baptists of Florida and is largely supported by the American Baptist Home Mission Society. It is normal and industrial in character and was founded for the purpose of assisting in the education of the colored race, opportunities for obtaining such an education being greatly needed.

Candidates for admission should be at least 14 years of age. Expenses per month are as follows: Tuition, $1; board, $6; washing, 50 cents. Also an incidental fee of $1 per year for boarding students and 25 cents per year for day students. Instruction in instrumental music costs $2 per month.

The management is in the hands of the faculty under the board of trustees. There are a president and 9 teachers in the faculty, 2 of whom are engaged in industrial work. There is a normal or academic course, a model-school course, including primary and kindergarten instruction, an elementary English course, and an industrial course, which includes the teaching of household duties and sewing and dressmaking.

The course in household duties includes cooking and taking care of a house and its contents. The course in sewing includes thorough instruction and practice in the various kinds of stitching, hemming, tucking, pleating, mending, darning, etc., making sheets, pillowslips, towels, aprons, underwear, simple gowns, children's wear, together with full instruction in use of sewing machine. The course in dressmaking includes cutting (with and without the use of a chart), making, fitting, and trimming dresses, except the more elaborate and costly;

the study of materials, prices, and buying; the selection of appropriate colors, etc.

During the school year 1900–01 the class in housework and cooking had 12 pupils, that in sewing and dressmaking, 40. There have been no graduates from the industrial classes as yet. The cost of the buildings and equipment of this school was about $10,000, and the annual expense of maintaining it is $5,000. Funds are raised by contributions from local Baptists and from the American Baptist Home Mission Society, and from fees, tuition, etc. The courses could be improved by making them more practical, and the outlook for so doing is said to be good.

CLARK UNIVERSITY, ATLANTA, GA.

Clark University was founded in 1870 by the Freedmen's Aid and Southern Education Society of the Methodist Episcopal Church. The motives which led to its establishment are said to have been "purely missionary." It is open to students of all classes, regardless of sex or color.

All students from a distance are required to board and room on the campus, unless specially excused by the faculty. Expenses are as follows: Board per month, $6.50; room, fuel, and light, $1.50; washing, per month, $1; incidental fee, per month, grade school, $1, all other courses, $1.50; laboratory fees, per term, biology, 50 cents, physics, 50 cents, all other courses, $1; late registration fee, $1; special examination fee, 50 cents; instrumental or vocal music, twenty lessons, $7.50, ten lessons, $4; industrial training fee, $1; fee for college and post-graduate diplomas, $5; fee for higher normal diploma, $3; fee for normal, musical, or industrial certificate, $2.

Five departments are included by the university—the college, the preparatory school, the normal school, the grade school, and the school of manual training. This latter includes a department of mechanics and a department of domestic economy. In the department of mechanics woodworking, blacksmithing, printing, and shoemaking are taught, and in the department of domestic economy dressmaking, sewing, and cooking are taught. While this department is called a "school of manual training," the officials state that occupations or trades are thoroughly taught. No student can be graduated from the school of manual training who has not been a member in regular attendance for at least one year, and no student who can not make a satisfactory set of required drawings and apply the principles taught in works with skill and dispatch can be granted a certificate of graduation.

There are 4 instructors in the department of mechanics, 1 each for woodworking, blacksmithing, printing, and shoemaking, and there are 6 in the department of domestic economy, 2 in both dress-making

and cooking, 1 in dressmaking only, 1 in sewing, 1 in art needlework, and a matron. In the year 1899–1900, for which this report is made, the number of students in the different industrial courses was as follows: Carpentry, 15; printing, 7; blacksmithing, 6; shoemaking, 6; cooking, 48; sewing, 175; dressmaking, 24; house-keeping, 29.

The buildings of the university cost about $75,000, and the annual cost of maintaining the schools is $16,000. The proportion of these figures applicable only to the school of manual training is not separable. The funds are raised by voluntary contributions, incidental fees, and amounts given by the Methodist Episcopal Church.

The president speaks of the school of manual training in effect as follows: "The courses are good enough; the difficulty lies in the fact that many students lack the means to complete them. Those trained in the school are occupying positions of usefulness, and from the fact that many of them come from distant homes the influence of the school is far-reaching. The students have been elevated by their education and have received better wages on account of it. The graduates of such schools are preferred by employers over merely shop-trained men, because they have theoretical as well as practical knowledge, and the shop training in the locality has been improved as a consequence of the success of such schools. Where a course of instruction in such a school as this has been taken, a graduate can work without going through a period of apprenticeship. These schools have, upon the whole, proved satisfactory and have attained the end for which they were established."

SPELLMAN SEMINARY, ATLANTA, GA.

Spellman Seminary is, according to the statement of its president, a literary, industrial, and trade school for colored girls. From the data at hand it appears that, as in some other schools of this class, the industrial instruction is hardly more than manual training—an adjunct to the general system of education—although an effort is undoubtedly made to teach thoroughly a few occupations. The seminary began its existence April 11, 1881. It has a college department, a missionary department, a normal and training department, a college preparatory and academic department, an English preparatory department, a nurse-training department, a musical department, and an industrial department. Its graduates in many instances become teachers.

The institution has about 20 acres of land, upon which there are 4 large brick buildings heated by steam, 4 frame dormitories, and a frame hospital for the sick. The cottage system is used, the boarding students being divided into 6 families. Applicants for admission must present testimonials of good moral character and pass entrance examinations. Board is $8 per month, in advance, and if one advance payment is made for the entire year a discount of 6 per cent is allowed.

Health and religious culture are carefully looked after. A fine reading room, library, and museum is furnished. Diplomas are awarded to those who have completed full courses, and certificates are given to those who complete the courses in the nurse-training department and the industrial department. Each student must give one hour a day to housework, and must also do her own laundry work. This is a part of the plan to educate girls for home life. No girl is paid for this work.

The courses in the industrial department are as follows: Domestic arts; housekeeping, an extension of the domestic arts course; cooking; washing and ironing; sewing and dressmaking; and printing. Of these, all except the last two courses seem to be given more to prepare the girls to act as teachers and mistresses of homes than to teach them occupations as such. This is also true to a certain extent of the last two courses. Under the industrial department there is 1 instructor in printing, 1 in dressmaking, and 2 in sewing. With these also may be reckoned 1 in charge of the laundry, 4 matrons of buildings, and 2 assistant matrons, all of whom give instruction in domestic arts and housekeeping. Some of these teachers are graduates of colleges and some of normal schools. The pupils in the industrial classes numbered as follows: Dressmaking, 63; printing, 32; housekeeping and domestic arts, 13; sewing, 402; nurse training, 47. No further separation into grades, etc., can be made, except to say that 23 of those taking the course of dressmaking and 17 of those taking the nurse-training course have no other studies and no connection with the general educational system of the seminary. The number of graduates of the industrial department can not be given, as it has proved impossible to separate them from the general list of graduates as shown in the records.

The value of the property is at present $200,000, and more than $100,000 is now being added in buildings, improvement of grounds, etc. The cost of maintaining the whole institution is $35,000 per annum. No separation can be made in the above figures of the proportion applicable to the industrial department alone. The funds for building, equipping, and maintaining this institution have been raised largely from private contributions, bequests, etc. The Woman's American Baptist Home Mission Society supports 15 of the teachers, and help received from the Slater fund has enabled the seminary to carry on the industrial department and to support the normal work.

The officers of the seminary have expressed the opinion that the industrial courses could be improved, particularly in the teaching of cooking, but no definite plans for such improvement have been made. This and other similar schools have resulted in increasing the intelligence and efficiency of the working classes in their sections and in promoting their general development. Students in such schools have

been elevated in every way and have been fitted for positions of responsibility, as a result of which they earn higher wages.

GEORGIA STATE INDUSTRIAL COLLEGE, COLLEGE, GA.

This institution, located at College, near Savannah, Ga., is a branch of the University of Georgia and was established under provisions of an act of the legislature, approved November 26, 1890. The need of opportunities for an education, both academic and industrial, for colored youths led to its establishment. For admission into the college the applicant must not be less than 14 years of age and of good moral character. Students may be admitted to special or elective courses of study. Tuition is free. Bedding and toilet articles must be furnished by the students. A matriculation fee of $5 for each annual session must be paid on entering.

So far as possible all manual labor in the college, such as farm work, care of grounds, buildings, dormitories, and recitation rooms, making fires, and ordinary repairs are performed by the students, and for such labor they receive compensation at the rate of 40 cents per day of 8 hours. Board is furnished in the steward's hall to pupils at cost. There are four general courses in the college: Industrial, preparatory, normal, and collegiate. The industrial course includes a department of trades, which was started in 1899. Each student is required to devote eight hours a day to his trade, and will receive no pay from any department until he has reached the stage where he is of real assistance in the work of his trade. Students completing a course in any one of the trades will be given a certificate of proficiency. The following trades are taught: Carpentry, blacksmithing, wheelwrighting, masonry, printing, shoemaking, tailoring, painting, and dressmaking. The dressmaking course is required of all girls. The courses of study are as follows:

CARPENTRY.—*First year:* Names of tools and parts of tools; use and care of tools; instruction and practice in sharpening and preparing tools, planing and sawing to dimension, bringing into use planes, saws, drawknives, gauges, squares, and levels; simple joints, including half-laps, etc., made by use of saws; mortises and tenons embracing draw-boring, pinning, nailing, screwing, gluing work, panel work, etc., and bringing into use brace and bits, chisels and mallet, rabbet, beading, and plow planes.

Second year: Building construction. Exterior work: Laying off for foundation, inspection of foundation; framing; simple roof construction; making and setting doors and window frames; sheathing, weatherboarding, boxing, shingling. Interior work: Flooring, ceiling, wainscoting; casing before and after plastering; fitting doors and windows. Elementary lessons in architectural drawing.

Third year: Building construction. Interior work: Making doors, sashes, mantels, stairways, including straight, broken, and circular stairways, with rails, balusters, newels, and panel work. Exterior work: Piazza and porch decoration; truss roofs. Architecural drawing and designing; estimating and contracting; talks on subjects pertaining to house construction. All work throughout the course will be made from drawings.

BLACKSMITHING.—*First year:* Use and care of forge; the study of iron; the forging of simple articles; the making of simple welds.

Second year: The kinds of welds; welding steel; the use of long and short laps; shrinking old tires; forging simple pieces to wagons and carriages; repairing wooden parts of wagons; talks on the anatomy of the horse's foot.

Third year: Tire welding, axle welding, ironing wagons and buggies; tool making, tempering, and annealing; practical horseshoeing. Such instruction in wheelwrighting will be given during the course as is necessary for a practical blacksmith; all work will be done from drawings made by the students.

MASONRY.—*First year:* How bricks are made; study of the soil used in brickmaking; classification of bricks; materials used in mixing mortar; use of gravel in mixing mortar, cement, and lime.

Second year: Spreading mortar on board and on wall; laying out wall dry and laying out wall with mortar; 8-inch wall with corners; 8-inch wall with chimneys and fireplaces; 16-inch wall with flues; 12-inch square piers and chimneys.

Third year: Sixteen-inch wall; use of headers; semicircular and segmental arches; laying off building; setting doors, windows, sills, and frames; semicircular arches over doors and windows; gothic arches and dovetail arches. All work is done from drawings; talks on building and construction throughout the course.

PAINTING.—*First year:* Names, uses, and care of brushes and tools; arrangement and care of shop; roof painting and use of wall brushes on weatherboarding; applying priming and second coats to weatherboarding; practice in trimming; sandpapering and applying lead coats; puttying and applying rough stuff; rubbing rough stuff; lessons in the mixing of the principal virgin tints; interior work with inside colors.

Second year: Further practice in applying second and third coats to exterior walls; complete course in farm-wagon painting; applying colors to buggies and first coat of varnish; interior work imitating wainscoting, graining, and staining; hard oiling and first lessons in frescoing; how to make different putties; striping carriages; cutting glass and glazing; frosting and staining glass; rubbing varnish with felt and pumice stone; further work in exterior decoration; advanced lessons in sign writing, gilding, and glass embossing; use of ladders and swinging stage.

Third year: Applying finishing varnish to carriages; fresco painting continued; practice in striping and ornamenting; stencil making; bronzing on wood, iron, and plaster cast, imitating marble; painting in distemper; talks on cleanliness in working and manufacture of pigments. Diseases common to painters, and cures.

TAILORING.—*First year:* Care of tools and workshop; correct position on board; how to thread needles properly and kinds of needles for different grades of work; stitches—backstitching, herringbone, sidestitching, serging, felling, flat and welt seaming, tacking, featherline loops and bars; sewing on various kinds of buttons; care of machine and parts; how to handle machine properly; practice on parts of pants—hip, side, top, fob pocket, flies, back strap, and the shrinking of surplus cloth; seaming, fitting tops, and the proper method of finishing trousers.

Second year: Repair work of all kinds; square, triangular, and circular patches; patch, flap, welt, and bound pockets; fitting of vest collars; amount of surplus cloth to be drawn in to make a firm and regular edge; sleeve making, coat facing under collar, quilting of canvas, and other minor parts in coat making.

Third year: Kinds of edges—bound, pipe, single, double, and raw; fitting collars and sleeves; French narrow and English broad buttonholes; neat and artistic finish on all kinds of coats; classification of goods; how to take measure—special care given to drafting and garment cutting; talks on economy throughout the course.

SHOEMAKING.—*First year:* Thread making; waxing threads and putting on bristles; names, uses, and care of tools; stitching and sewing; patching; half soling; finishing; repair work.

Second year: Repair work continued; quality and different classes of work; making

of new work; topping; lasting; insoling; inseaming; sewing and nailing soles; making toppings.

Third year: Measuring feet and making shoes to fit; special course in fitting shoes to crippled and deformed feet.

SEWING.—*First year:* One half day a week to each class. First lessons consist of talks on cloths—cotton, linen, silk, and wool; threads, warp, and woof are developed; manner of weaving and average widths of cloth; workbox—articles necessary and care of each. The stitches used in plain sewing are carefully taught in the following order, viz, basting, running, overcasting, overhanding, backstitching, hemming, gathering, regulating gathers, blindstitching, darning, and patching. Seams—felled, French, hemmed, Dorothy, and backstitched. Hems—faced, extension, rolled, hemstitched, French, blind, slipstitch. Patches—overhanded and hemmed—are to aid pupils in mending torn garments neatly and accurately. Buttonholes, loops, eyelets, and hooks and eyes are taught by practice work on oblong squares; the length of thread to sew with is taught with this part of the work; sewing on buttons properly; matching plaids, stripes, and figures; fancy stitches—brier, herringbone, feather, button-hole, and outline stitches are taught to help pupils in beautifying simple material; dressmaking begun.

Second year: The first year's work continued. Taking measures and drafting patterns; underwear, shirt waists, children's dresses, and thin dresses are made from drafted patterns. Color talks are given. Drafting continued.

Third year: Second year's work continued, and dressmaking by parts commenced. The skirt, lining, canvas, and goods cut, basted, fitted, stitched, pressed; putting on braid, finishing placket, sewing on belt and "hangers," hooks and eyes complete that part of the work. The basque lining cut—right and wrong way to cut taught; goods cut next, matching plaids, stripes, figures, and up and down of pile in velvet; basting basques, fitting, paring seams, pressing, sewing on hooks and eyes, right and wrong way. Boning basque and making sleeves, collar, and "hangers" complete the waist. Each pupil is required to make a complete set of bed linen, underwear, and at least one dress before finishing the course.

The object is to give each pupil a thorough knowledge of plain and fine sewing. Hints on embroidery, millinery, and interior decoration are given outside of school hours. Each pupil keeps a record of verbal instructions and work done by herself. To become a finished dressmaker requires three years.

The course in printing has not yet been laid out. There are 9 instructors in the department of trades. As this department has just been started there have been no graduates.

The buildings consist of a dormitory, two school buildings, chapel, farm house, blacksmith shop, wheelwright and carpenter shops, and four cottages for the teachers. The cost of these buildings was about $50,000, and the annual cost of maintaining the college is $16,000. Funds come from State appropriations and from the grants by the United States of the proceeds of public lands.

From an official of the institution the following statement was obtained: "The courses of instruction can undoubtedly be improved as the school grows older; they can be made more practical; trade teaching, having just been begun in this school, has had little if any effect so far upon the industries of the State or upon the working classes, but the influence of the general educational system of this and similar schools has been to increase intelligence and to promote industrial, educational, and social development among the working people. Those

who have been under the instruction and influence of such schools have greatly improved in efficiency; they do better work and get higher wages and more rapid promotion by reason of the preparation for work secured by their school education; the graduates of such schools are preferred by employers, because they are more intelligent and regular in the discharge of their duties; the influence of such schools has led to the improvement of ordinary shop training; their graduates are able to get work at all the trades without passing through a term of apprenticeship."

CENTRAL CITY COLLEGE, MACON, GA.

This is a school but recently started by the Missionary Baptist Convention of Georgia (colored).

The courses of instruction are academic, collegiate, theological, and industrial. The industrial course has four branches—carpentry, sewing, cooking and domestic science, and farming and dairying. Printing is also taught, but only in an elementary form. The general management is in the hands of the board of trustees and the principal of the school. The instructors have been trained in the Spellman Seminary of Atlanta, the Lynchburg Seminary, the Atlanta Baptist College, the University of Chicago, and similar institutions.

In the industrial branches the number of pupils is as follows: Carpentry, 25; sewing, 16; cooking and domestic science, 43; and farming and dairying, 12. In these branches the attempt is made to teach the occupations thoroughly—the instruction goes beyond mere manual training. There have been no graduates as yet. The building now in use cost $10,000, and the annual cost of maintaining the school is $3,000. The proportion of these figures applicable to the course in industrial training is small at present. The funds are contributed by the Missionary Baptist Convention of Georgia.

In the opinion of the officials of this school its industrial courses could be improved by the addition of more modern tools and appliances, and the outlook is encouraging. The school has already created an educational sentiment and is increasing the intelligence and efficiency of the working classes. Graduates of similar schools in Georgia are preferred to shop-trained boys because they have theoretical knowledge in addition to practical. They get work at their trades without undergoing a period of apprenticeship. The school is too young to have it said that it has proved satisfactory, but the management is encouraged to believe that it will be, and that it will attain the end for which it was established.

HAVEN HOME AND INDUSTRIAL SCHOOL, SAVANNAH, GA.

This school was started in 1885 by Mrs. S. M. Lewis and Miss Viola Baldwin, under the auspices and support of the Woman's Home Missionary Society of the Methodist Episcopal Church. Its aim is the

training and culture of poor colored girls, who are taken into the home and taught domestic industries. The special need leading to the establishment of the school was the desirability that the colored children should be taught such useful occupations as would enable them to support themselves and make their homes happier and brighter. The general management is under the principal of the school as directed by the supervising committee.

From 8.45 a. m. to 2 p. m. each day is devoted to regular school work, besides an evening hour for study. The remainder of the time is divided between housework and sewing. Fifty cents per year is charged for the use of school books; day students furnish their own books and pay 50 cents per month tuition. Board in the home is $5 per month.

The industrial courses taught are sewing, cooking, and laundry work, and are designed to fit the girls for taking care of their homes, or to earn their living as teachers, domestic servants, and seamstresses. The total number of instructors is 6, educated in Clark University, Fredonia Normal School, and Clarion State Normal School. There are 40 pupils in the school at present. But 60 have regularly graduated, though 700 girls and 15 boys have received more or less training in the school since it was started.

The buildings used cost about $10,000, and the annual cost of maintaining the school in all its branches is $3,000. The funds for supporting the institution are raised from fees, contributions of individuals, etc., and one-third is provided by the Woman's Home Missionary Society of the Methodist Episcopal Church.

The officials of this school believe that with more room and money their industrial courses could be improved. The effect of this and similar schools has been to improve the home life and to increase morality. Those educated in such schools receive better wages and have steadier employment. The graduates are more desired by employers than others because they are better trained, and schools of this kind have proved satisfactory; but more trades or occupations should be taught.

GILBERT ACADEMY AND INDUSTRIAL COLLEGE, WINSTED, LA.

The need of a school of a thoroughly practical character for the education and training of the colored race led to the establishment of this school. It is supported by the Freedman's Aid and Southern Education Society, and the board of managers of that society are its trustees. It is now a branch of the New Orleans University.

The school "is open to young men and women of all races and religions," but only colored pupils have availed themselves of its privileges. Applicants must furnish satisfactory evidence of a good moral character. Students whose parents or guardians do not live in

the village must board in the school building. Tuition is free. An incidental fee of 50 cents per month is charged each pupil. Board is $6 per month, payable in advance. Boarding students must furnish their own bedding. Young women do their own washing, and young men are charged 50 cents per month for having washing done. An extra charge of $2 per month each is made for music, stenography, typewriting, and drawing.

The institution may be considered as having two departments of instruction, academic and industrial. The industrial department is independent of the academic and its courses are not compulsory; but, owing to the large number who desire to take them, only those who expect to become workmen are encouraged to enter upon them.

For the year 1899–1900 the number of pupils pursuing the industrial courses of study was as follows: Agriculture, 40; floriculture, 5; dairying, 3; printing, 10; carpentry and cabinetmaking, 11; needlework, 32; blacksmithing and wheelwrighting, 11; baking and cooking, 6 males and 47 females; painting, 3; and laundry work, 44. There have been but 15 graduates so far.

There are 14 members of the faculty, of whom 6, all graduates of this academy, are engaged in teaching trades. The industrial building and its equipment cost $5,800. To maintain the industrial work costs about $1,000 per annum. As the industrial department is carried on in connection with the academic, the cost is low; in the opinion of the faculty, were it carried on by itself it would cost at least $3,000 per annum. The funds are supplied from the interest on a small endowment and by the Freedman's Aid and Southern Education Society.

Facts and opinions gathered from the officials of this institution are to the following effect: The courses could be improved by having them made longer, and the outlook is good for such improvement, as people are now inclined to aid industrial schools. The graduates exert an influence for good in their communities and labor to raise the intelligence of those around them. They get higher wages than workmen educated in the shops only, and as they are better prepared for work they are preferred by employers and do not have to pass through a period of apprenticeship when beginning work. Schools of this character have tended to improve the training given in shops, are generally successful, and are fast attaining the ends for which established.

TOUGALOO UNIVERSITY, TOUGALOO, MISS.

This is a school for the education of the colored youth of both sexes. It was started in 1869 by the American Missionary Association, which, with funds specially given for that purpose, purchased 500 acres of land and a large mansion that had been erected just before the civil war. In the next two years two other buildings were erected, so that

in 1871, when the school was chartered by the State, there were boarding accommodations for about 60 students.

In 1872 the school was adopted by the State as one of its normal schools, but in 1877 State support was withdrawn. In 1879 a board of visitors was appointed on the part of the State, and from that time until 1892 the State appropriated from $1,500 to $3,000 a year for the support of the normal department. Since then this appropriation has not been made, as the school, not being conducted as a free school, can not receive State aid under the constitution.

The general management is in the hands of the president and faculty.

In the university there are the following schools and courses of study: The Daniel Hand kindergarten and primary school, for day pupils only, used as a school of practice and observation for those training to be teachers; the grammar school, which receives pupils from the fifth to the eighth grade, and prepares for the academy and the teachers' training courses or normal school; the academy, with classical and scientific courses, fitting for college and also designed for those who may not desire to attend school longer; and the teachers' training course or normal school intended to meet the needs of those who wish to fit themselves for teaching in the schools of the State. Industrial work in some form is combined with all the above courses. A college course was begun in the fall of 1897; there is also a musical department and a biblical and theological department.

The industrial work, as above stated, is given to all students of the primary, the grammar, and the normal schools, and of the academy. This is principally in the form of manual training and training in the branches of domestic science, and the regular courses in these, including wood and iron working, mechanical drawing, cooking, etc., last four years.

After completing the regular course, advanced work is given for those who have shown special aptitude and wish to learn a trade, and special arrangements are made for those who wish to attend this school for the express purpose of learning a trade or occupation.

Certificates of proficiency are given to those completing a trade course. Trades and occupations are taught, as follows: Carpentry, cabinetmaking, blacksmithing, mechanical drawing, farming, gardening, cooking, housekeeping, needlework (including hand and machine sewing, dressmaking, and art embroidery), and millinery.

During the school year 1899–1900 the number of students in each course was as follows: College, 7; academy and normal school, 46; grammar school, 165; kindergarten and primary school, 186; night school, 24; music department, 47; and industrial works, 288 (carpentry, cabinetmaking, and blacksmithing, 75; needlework, 98; millinery, 12; cooking, 70; housekeeping, 11; farming and gardening, 22). The

total number of students, not including duplications contained in the above list, was 436.

The number of those who were actually learning trades and the number of trade graduates have not been obtained, but the total number of graduates up to the year 1899–1900 was 92.

There are 27 members of the faculty, 5 of whom teach in the industrial courses and are graduates of the Hillyer Institute (Y. M. C. A.), of Hartford, Conn., Pratt Institute, of Brooklyn, N. Y., New York School of Domestic Science, of New York City, and the Atlanta University, of Atlanta, Ga.

The existing buildings and equipment are valued at about $100,000, and the cost of maintaining the school is $18,000 annually, the funds being obtained from the American Missionary Association and from contributions.

Applicants for admission to this institution, except for the kindergarten school, must be 14 years of age and must pass the required examinations.

The expenses are 25 cents per week for tuition, $1.75 per week for board (including furnished room, lights, and plain washing), 50 cents per term as an incidental fee, which helps to provide books and periodicals for the library and reading room, and $3 per month for instrumental or vocal music for those taking lessons therein. Each student must furnish his own lamp chimneys, towels, and soap. The total expense of board, tuition, and incidental fees for the year of eight school months is $65.50. From those who wish to pay in advance for a whole year $60 cash will be taken for full amount.

Those remaining at the school during the winter and spring vacations will be charged 25 cents per day for board. All needed text-books can be purchased or rented from the treasurer. The rent of the needed books is $1 per year.

About a dozen boys can, by working on the farm and in the garden, pay their way in full, receiving instruction in the night school. The same number of girls can work their way in the boarding hall. Work aid to a limited amount may be given to others.

On behalf of the management it is stated that there is a constant development and improvement in the courses taught, it being the endeavor to work toward industrial training for the masses and special instruction for the trades; that years ago an apprentice system at the trades was tried, but failed, as it gave industrial training to a limited number only, and that the present system is far more successful. It is also stated that there are no industries in the locality of the school, except a few blacksmiths and carpenters; many of the graduates come from a distance and upon graduation either return to their homes, where they exert a strong influence for good and often become leaders of their people, or become useful citizens in other places where they locate;

those who have been under instruction in the school have improved in every respect, and higher wages, steadier employment, and more rapid promotion certainly accrue to them as a result of their good preparation for work, and they are preferred by employers over shop-trained boys by reason of their increased intelligence and fine training.

It is said that the school-trained workmen can get work at their trades without undergoing a period of apprenticeship.

The school is considered to be very satisfactory, and its students are developed in character and add much to the economic wealth of the communities wherein they locate.

ASHEVILLE ACADEMY AND INDUSTRIAL SCHOOL, ASHEVILLE, N. C.

This institution for colored girls, now in its fifth year, is a general educational institution, having primary, grammar, and normal departments, and teaching, in the Allen Industrial Home, connected with the academy, all branches of domestic science.

The training of the home is intended to prepare young colored women and girls to conduct properly their own homes, or to render acceptable service to those who may employ them. It consists of a three-year course, which includes sewing, dressmaking, cooking, and laundry work. Pupils completing this course will receive a certificate of attainment. No pupil will be received in the home for less than three months.

The management is in the hands of the superintendent and faculty, and is conducted under the auspices of the Woman's Home Missionary Society of the Methodist Episcopal Church. There are 5 teachers, 1 of whom is a graduate of this school and 1 a graduate of Fredonia (N. Y.) Academy.

In the different industrial courses in the year ending in May, 1901, there were 90 pupils in sewing and dressmaking, 27 in cooking, 27 in laundry work, and 35 in general housekeeping. There have been but 6 graduates up to and including the year 1900, but many who have not completed their courses have left the school and are at work.

Tuition and board are payable in advance. The terms are as follows: Board in the Industrial Home, $6 per month, or $50 per year; tuition in normal or grammar departments, 50 cents per month, or $4 per year; tuition in primary department, 25 cents per month, or $2 per year; instrumental music, 25 cents per lesson; elocution, four lessons for $1.

The cost of the buildings was: For the school building, $5,000, and for the Allen Home, $11,000. An adjoining lot, worth $2,500, has been donated. To maintain the school in all its departments costs $3,300 per year. The funds are obtained by donations and contributions of friends and church societies.

Information obtained from the school faculty is to the effect that an extension of the courses is desirable, but on account of lack of means the prospect of improvement is poor.

The pupils of the school have learned to take care of their own homes and those of others, and many applications for help have been filled from among the students at high wages. This school has been a great stimulus to other schools and very helpful among the young.

As a result of their preparation for work, the girls of this school are said to secure better employment and higher wages than they could otherwise have done. When taken into the school they are crude and ignorant, but when they leave they can fill good positions as cooks, dressmakers, etc., and give satisfaction, and are greatly preferred by employers to those without the school training.

The school has proved very satisfactory, but more means is needed to extend it on other lines of industrial training.

HIGH POINT NORMAL AND INDUSTRIAL SCHOOL, HIGH POINT, N. C.

This school was established in 1891 by the Board of Home and Foreign Missions of the New York yearly meeting of Friends.

The management is by the principal and faculty under supervision of the local advisory board of the Society of Friends. It conducts an academic department, a music department, and an industrial department. The graded-school course of the city of High Point is also conducted by this institution under an arrangement with the school board of the city, and a night school also forms one branch of the school.

The industrial department has courses in domestic science, sewing (including dressmaking), and cooking, for girls; in mechanics, bricklaying, plastering, blacksmithing, carpentry, free-hand drawing, mechanical drawing, and farming, for boys. The courses of instruction are as follows:

Sewing.—It is the aim to give the girls all those things which are essential to thorough development. Each girl who enters the boarding department is required to sew a certain number of hours each week. The sewing room is furnished with all articles necessary to make instruction thorough and satisfactory.

First year: Instruction in use of needle, thread, thimble, and cloth; drills on basting, overcasting, running, stitching and backstitching; turning, basting, and hemming of hems of different widths; buttonholes; making of bags, towels, and aprons.

Second year: Review of first year's work; buttonholes; putting on hooks and eyes, felling straight and bias fells; hemstitching, gathering, and overhanding; putting on bands, putting in gussets; cutting and making of drawers, skirts, and dolls' clothes.

Third year: Review of second year's work; darning and patching; instruction on the manufacture of needles, pins, thimbles, hooks and eyes, etc.; cutting from pattern and making of plain under-garments of all kinds.

DRESSMAKING.—*First year:* Instruction on different kinds of and manufacture of cloths; on quality, color, their harmonious blending and contrasting; on matching of plaids, figures, and stripes; use of machine; its parts and their uses; cutting, basting, fitting, and finishing of plain waists; cutting, basting, hanging, and finishing of plain skirts; making of collars, putting in whalebones, etc.

Second year: Drafting by system, cutting and fitting of garments by measure, making of trimmed waists and skirts by measure. It would be well for those who take dressmaking to provide themselves with cloth and necessary articles for such a course.

COOKING.—All girls are given thorough instruction in plain cooking. Each girl of the boarding department is required to cook a certain number of hours each week. She must provide herself with two sets of white caps, sleeves, and aprons, also notebook and pencil.

First year: Plain cooking, including breads, meats, gravies, vegetables, soups, and pies.

Second year: Review of the first year's work, and preparing such as meat sauces, puddings, pies, cookies, and cakes.

Third year: Review of all previous cooking, and the making of such as salads, potting meats, jellies, ices, and fancy cakes.

BRICKLAYING.—Proper use of ordinary bricklayer's tools; making mortar beds and boards; building scaffolds; screening and slacking lime, mixing mortar, selecting brick, choice of lime and sand, hod carrying, spreading mortar, use of cement, cleaning brick, laying brick pavement, running courses to line, use of wood brick, laying foundations with footings, running up corners and walls to height, use of stretchers, headers, half-headers, rowlocks and ties, laying tiers, settling sills, setting windows and door frames, striking joints, flat, hollow, and round; making plasters, panel work and brick cornice; laying off and building arches, square, bonded, and circular; building chimneys and stacks. Work is done from drawing.

PLASTERING.—Making mortar and putty; use of hair, lathing, plastering walls and ceilings, plastering to grounds and to finish, scratch coating, second and third coating, floating, hard finish, and stucco work. Theory as well as practice will be given in both courses. Stress is placed upon neatness and precision of work.

MECHANICS.—A thorough knowledge of practical mathematics will be given to fit the student for the work of this department. The following course will be pursued until students are able to take more difficult work: How to manipulate tools and machinery, and the use of the same; making of joints and curves; wood turning; wood carving; cabinetmaking; carpentry; free-hand drawing; instrumental drawing.

BLACKSMITHING.—A three years' course, embracing the following work: Welding, enlarging, swaging, scroll work, horseshoeing, thread cutting, and drill work.

FARMING.—The school owns a fertile farm of 90 acres where agriculture is studied. Five acres have been set apart for a model farm, where a practical and experimental farming course is carried on. The course of instruction is as follows: Nature of soil and drainage; fertilizers and manures; use of farm tools; tests of seeds and seeding crops; care of stock and a practical knowledge of dairying and dairy products.

The school owns horses, hogs, cows, one mowing machine, one wheat drill, one reaper, plows, wagons, and other farm implements.

In the school year of 1900–01 there were 155 students taking these courses. There are 12 members of the faculty, of whom 5 are engaged in teaching trades. Two of the instructors were educated in St. Augustine's School, 1 in the North Carolina Agricultural and Mechanical College, 1 in the University of Pennsylvania, 4 in the Hampton Institute of Virginia, 1 in Fisk University, 1 in Shaw University,

1 in Leonard Medical College, and 1 in Earlham College. There have been no graduates as yet in the industrial courses.

The expenses are as follows: Board, fuel, and laundry, per month, $7; tuition, day students, $1; incidental fee, $1. A limited number of students work in the daytime, at the rate of 5 to 7 cents per hour, and attend school at night the first year, after which they are placed in the day school. No cash is paid for this labor, but it is counted against the charges for board, tuition, etc. All boarding students are allowed at least two hours per day to work at the above rates. Work students must not be under 16 years of age, must be in good health and able-bodied, and must provide themselves with clothes, shoes, and medicine and be responsible for doctor's bills for at least six months.

Students must bring, or purchase on arrival, a Bible and a dictionary, must be supplied with hairbrush, comb, toothbrush, clothes brush, shoe brush and blacking, and must provide their own sheets, pillowcases, towels, napkins, and toilet soap.

This school has been in active operation only about six years, and the cost of buildings, land, and equipment was approximately $20,000. It costs about $12,000 annually to maintain it. The money is raised from tuition and other fees, from donations from friends, and from appropriations by the State and city.

Officials of the school state that in the trades taught the courses are satisfactory, but that it would be advantageous could more trades be taught in the school; that the industries of the locality have been benefited by the establishment of the school, though no specific data can be given; that the course of training increases the intelligence of the students, and on account of that fact they work better and more intelligently than those who have not received such training. It is also said that although the school has no graduates as yet, still many who have nearly completed their courses leave and obtain work, and they always get better wages and give better satisfaction than those who have not had a school training. Those who have nearly completed their courses go right to work as full workmen and have no apprenticeship to serve. The school is, generally speaking, satisfactory, but from lack of means, etc., has not yet fully attained the end for which it was established.

ST. AUGUSTINE'S SCHOOL, RALEIGH, N. C.

This school was incorporated in 1867 and began its work in 1868. Its purpose was to train young colored men and women in the elements of an English education, to prepare them for teaching, and to add collegiate studies for those able to take them. The need of so educating the young that they might be able to earn a better living led to the establishment of industrial courses at a comparatively recent

date. There are the following departments at present: Collegiate, normal, preparatory, and industrial, and a training school for nurses.

There are two terms of four months each in the school session. A fee of $6 per month is charged, and students must render thirty-five hours of work each month. The charge may be reduced from $48 to $45 a year, provided the students enter on the first day of the session and remain through the entire school year. Payment must be made in installments of $20 at the beginning of the session and $25 on the 1st of January. Day students are charged only $1 per month. Each student must provide three sheets, two pillowcases, blankets, and towels, and in addition the girls are required to have an umbrella, waterproof, and overshoes, and the boys overalls or suitable clothing for outdoor work.

The general management is in the hands of the president and faculty in number 23. Of these, 6 are employed in teaching the industrial courses.

In the industrial department the young women have the care of the household and the young men the care of the grounds, the farm, and garden. Instruction is given to the girls in sewing, dressmaking, and cooking, and to the young men in farming, gardening, carpentry, bricklaying, masonry, and printing, and in these courses it is possible for them to obtain a thorough knowledge of the trade taught. The number of students in the industrial courses during the school year 1900–01 was 38. The only graduates as yet from the industrial courses were 9 from the course of cooking last year.

The cost of maintaining the school in all its branches for the year of 1899–1900 was $14,844.90, and the funds were obtained from interest on endowment, tuition and other fees, and contributions from friends.

The industrial department of this school is new, but the courses are said to be the best that can be given under present conditions. They could be improved if more money were available.

SHAW UNIVERSITY, RALEIGH, N. C.

Shaw University was founded in 1865 for the purpose of educating the freedmen. All the students, except those in the schools of law, medicine, and pharmacy, spend considerable time in industrial training. Blacksmithing, iron and steel working and turning, cabinetmaking, carpentry, mechanical and free-hand drawing, sewing, and dressmaking are taught. The aim is to give the young men and women a practical training rather than to teach them trades, yet the occupations are so thoroughly taught that many of the graduates are capable of earning a livelihood and do earn one by work at the occupation learned in the university. The bulk of the students, however, become teachers and preachers.

SLATER INDUSTRIAL AND STATE NORMAL SCHOOL, WINSTON-SALEM, N. C.

Four ideas were prominent in starting this school: (1) The vital importance of training for good citizenship; (2) a belief that the negro should be taught to work intelligently with his hands as well as to become acquainted with the branches usually taught in the schools; (3) the great need of a normal school for colored people, a place where teachers should be taught how to teach; (4) a negro colony where colored people should live, owning their own homes, starting their own industries, and to a certain extent governing themselves.

Through the labors of the present president of this school and with the cooperation of the leading citizens of Winston-Salem, N. C., a board of trustees was organized in 1892 to establish a school embodying the ideas above set forth. A valuable tract of land near the city was donated by a number of interested citizens. Others erected a recitation hall and assembly room in which to begin the school, which was called the "Slater Industrial Academy," in honor of the late John F. Slater, who gave a million dollars for the industrial training of negroes in the South. Soon after the founding of the school the county board of education of Forsyth County adopted the school and made provision for the carrying on of a public school in connection with the academy. In 1895 the legislature of North Carolina appropriated $1,000 per annum for the school, and in 1897 it more than doubled this amount. Forsyth County appropriates a small sum for the school each year, and an annual appropriation from the Peabody fund is also received by the school. In addition, voluntary contributions are made by local friends of both races and by friends in the North.

The school is normal, academic, and industrial in its character, and is managed by the State board of education, a local board of management, and by the president and faculty, which numbers 15, of whom 4 give instruction in the industrial classes.

The cost of the buildings and equipment now in use by the school was about $15,000, and the cost of maintaining it is about $6,400 annually.

The expenses are: Board, payable in advance, $5 per month; washing, 50 cents per month; fuel, 50 cents per month; tuition to day students, payable in advance, $1 per month. All students must furnish their own lights and must bring their own bedding, including quilts, sheets, and pillowcases.

The privileges of the institution are not limited by sex or creed. All students registering must furnish satisfactory evidence of good moral character.

The school has an academic department, a normal department, a department of the English Bible, a department of music, a commercial department giving instruction in bookkeeping, business law, type-

writing, and stenography, and an industrial department. In this last department instruction is given in sewing, cooking, laundry work, and domestic economy for girls; and shoemaking, carpentering, ironworking, brickmaking, and agriculture for boys.

During the school year of 1900–01, 116 students were taking the industrial courses, and there have been 20 graduates therefrom, many more having had the benefit of the training but not graduating.

The feeling exists among the managers of the school that the industrial training could be improved by extending the courses, and the hope is expressed that a textile school will be established in the near future.

It is said that those who attend the school become better citizens, more intelligent, more efficient in every respect, and improve in conduct. They are also more steadily employed, have better wages, and take and do a higher grade of work than those who have not attended the school.

It is also said that the graduates of this and similar schools are everywhere preferred to merely shop-trained workmen, and they are more intelligent and can be trusted to do things by themselves. On this account a spirit of emulation has been aroused and there has recently been a change for the better in shop training.

The work of the school has been exceedingly satisfactory—more so than was expected—and the entire neighborhood seems in accord with its efforts.

SCHOFIELD NORMAL AND INDUSTRIAL SCHOOL, AIKEN, S. C.

This school was started in 1868 by Martha Schofield, its present principal, in a little frame schoolhouse. To-day the property, entirely free from debt, is worth $30,000, and includes two substantial brick buildings and two frame buildings in Aiken, S. C., with a farm of 281 acres 3 miles distant from the town. The school is the result of a need "for an institution to train colored pupils to meet the problems and conditions of life they have to confront, and to make them better fitted to meet the duties that will come to them as brothers, sisters, parents, or citizens. In the country places, in the towns and villages of the South, are hundreds of young colored men and women growing up in the densest ignorance. In our schoolrooms they receive thorough training and industrial instruction which fit them to take up the duties of everyday life."

Applicants for admission must give evidence of a good moral character. Students from a distance must board at the school. In the boarding department only girls of 12 years of age or over and boys of 15 years of age or over are taken.

The terms are as follows: $6 per month for board, room, fuel, and light, or $5 a month each where more than one pupil comes from the

same family or for those who have been teachers in the public schools; 50 cents a month for boys' washing - girls do their own washing in the laundry; 50 cents a month for tuition and the use of text-books.

There are 17 instructors, of whom 10 give instruction in the industries taught.

All the boarding students have the privilege of learning trades during the afternoons and on Saturdays. The course in each trade is four years, but may be extended if students are irregular in attendance or are backward in their work. Certificates are not given in any trade until it is thoroughly mastered. A limited number of day students are also allowed to take up special industries, and their work is accepted in lieu of tuition fees. The trades taught are as follows:

Printing: This has been taught for over twenty years, and graduates are to be found all over the South. The monthly newspaper and school stationery are printed by the students, the leading hotels patronize the school press extensively, and the check and pass books of the bank of Aiken are printed and bound here.

Harness making: No machines of any kind are used in this department, but everything is handmade and the work turned out competes successfully with the best.

Carpentry: The first year in the carpenter shop is devoted exclusively to repair work. Later new work is taken up. The instructor in this department is both a carpenter and a cabinetmaker and is fully qualified to carry his pupils from the simplest operations with the plane and square to the most intricate ones in furniture making.

Blacksmithing: There is a conveniently arranged shop, supplied with a few tools, where repairs are made for the farm. There is no regular instructor at present, and additional tools are also needed. It can not be said that the trade is really taught.

Farming: Industrious boys of good character are given work on the farm at $7.50 per month, which is paid over to the boarding department for school purposes when the engagement terminates. Five and one-half months' work pays board and tuition for the whole term. While this is being done, useful information about farming is being imparted.

Shoemaking: This department was opened for girls in 1897, and many have learned to half sole, heel, and patch as well as the average country shoemaker. They expect to devote four years to the trade and to complete it.

Sewing: Mending is necessarily the first and most important part of this work, though a great many sheets and pillowcases are made, a quantity of underwear, and a number of dresses. An advanced class is taught, in which a number of girls learn to cut, fit, and make dresses.

Cooking: A systematic course, in which the girls receive instruction three times a week.

Housekeeping: This includes sweeping and scouring, dusting and arrangement of rooms, washing of dishes, setting of tables, etc.

Laundering: Facilities are provided for 12 girls in the washroom and 8 in the ironing room, who are instructed in the best methods of washing and ironing.

Storekeeping, for the sale of old clothing donated to the school and for the instruction of students, has been a leading feature of the work since 1882. During the busy season there have been over 100 customers a week, who were waited on by the students under the supervision of a teacher. The one-price system is adhered to, exactness in small things is observed, and business conducted on a strictly cash basis. During the year ending May 31, 1900, the receipts from the sales of old clothing at the store was $1,665.45.

The number of students receiving instruction in the foregoing industries is as follows: Printing, 7 boys and 3 girls; harness making, 8 boys; carpentry, 10 boys; shoemaking, 4 boys and 2 girls; chair caning, 4 girls.

The cost of maintaining the school for the year ending May 31, 1900, was $5,991.18, and the funds came from interest on the endowment fund, voluntary contributions of friends in the North, public school fund and tax from pupils, sales of stationery, balance left from income of previous year, etc.

From statements of the school authorities it appears that while the courses of trade instruction are excellent they could be improved by the use of money in purchasing tools and material and by increasing the number of trades taught; that the school has done much to raise the intelligence of those who have attended it and has a good effect upon the laborers of the locality generally, and that it has caused those who have received its training to obtain higher wages and steadier employment than they would otherwise have received.

It is also believed by the school officials that the graduates are preferred by employers to those whose only training was received in the shop, as the school graduates are better prepared for the work. They do not have to pass through a period of apprenticeship at any of the trades taught in the school. It is also said that the school has proven satisfactory and is constantly increasing in efficiency.

CLAFLIN UNIVERSITY, ORANGEBURG, S. C.

The existence of this institution is due largely to the generosity of the Hon. Lee Claflin and family, of Massachusetts, which made possible the purchase, in 1869, of the original site of the Orangeburg (S. C.) Female Seminary, consisting of 6 acres of land and several buildings. Later two tracts of land adjoining the original purchase were secured, containing, respectively, 37 and 31 acres. The university was established for the purpose of educating the youth of the colored race.

By an act of the legislature, approved March 12, 1872, the College of Agriculture and Mechanics' Institute for colored students was located at Orangeburg. An experimental farm, containing about 116 acres, adjoining the property of the university, was purchased. For the sake of greater economy and efficiency the two institutions, while distinct in every other particular, were placed under one management.

In 1896 Claflin University, in obedience to the action of the general conference, which declared against the union of church and state, separated from the State institution, and is now under the control of the Freedmen's Aid and Southern Education Society of the Methodist Episcopal Church.

It was recognized that there was great need of an institution where trades could be taught, and the John F. Slater fund making it possi-

ble to commence in that line, the department of manual training was established in 1883. The object of this department is to give instruction in manual training and to teach trades in connection with literary studies.

Certificates are given to those completing the industrial courses and diplomas to those completing the classical and other courses.

The boarding department is conducted on the club plan. This arrangement gives the students a voice in the selection of the daily bill of fare. After an experience of several years it has proven to be the most satisfactory plan for all concerned. The best quality of food is used, and in sufficient quantity and variety. Two kitchens are set apart for self-boarders. By this arrangement students who live near and those who wish to practice economy can provide for themselves. Many students claim to board on from 30 to 50 cents per week.

The university provides rooms for students, each furnished with bedstead, mattress, table, chairs, and washstand. All other articles, such as quilts, sheets, pillowcases, spreads, mirrors, towels, soap, lamps, bowl and pitcher, books, Bible, napkins, teaspoons, and tumblers, must be furnished by the students The university store provides at very low rates all kinds of groceries, stationery, books, etc.

The expenses per month are as follows: Matriculation fee, 50 cents; primary department, 60 cents; English department, $1; preparatory and normal department, $1.50; college department, $2; room rent, $1; extra fuel—self-boarders, 50 cents; board at university tables, $5.50.

The department of industrial training contains the following courses: Mechanical drawing; architectural drawing; woodworking, carpentry, etc.; masonry, lathing, and plastering; ironworking; painting, house and coach; printing.

The Simpson Industrial Home, established by the ladies of Philadelphia in memory of the late Bishop Mathew Simpson, is a two-and-a-half story building. It is under the care of a matron, who gives daily instruction in the art of domestic economy. Several girls reside permanently in the home; others are sent by classes from the university for instruction therein. It is a part of the university, and is under the auspices of the Woman's Home Missionary Society of the Methodist Episcopal Church. Plain sewing, dressmaking, and cooking are here taught.

An outline of the industrial work is as follows:

Mechanical Drawing.—All working drawings come under this head. There is, however, a special course in mechanical drawing, to which the senior normal and preparatory students are admitted. This course comprises the drawing of the ellipse, spiral, cycloid, epycycloid, and hypocycloid, helix, screw threads; projections; pyramids; oblique views; truncated pyramids, oblique views of the circle; development of surfaces; truncated cones; intersecting solids, cylinders, and cones.

Architectural Drawing.—Names, uses, and care of instruments; practice drawing of simple geometrical forms; copying plans and elevations of small frame cottage;

copying exterior and interior details of cottage; making plans, elevations, and details of small brick building; working out details of the classic orders; drawing of ornaments; study of materials; principles of designing; lectures on superintendence.

Woodworking.—The classes in woodworking are made up of the normal and college preparatory departments. Girls report to light woodworking and drawing, taking the course with the boys. This is done because it is educative; that they may be made familiar with tools and the use of the same; for physical exercise, and, lastly, that those who are to teach may be better able to do kindergarten work. The course of study in woodworking covers three years.

The first and second years of the woodworking course are compulsory, a third year is elective, allowing woodworking, masonry, or painting. The woodworking department is equipped with a 16-horsepower gasoline engine, planer, and matcher, ripsaw, bandsaw, lathes, mortising machine, emery wheels, and a single-head patent freizer. Students are taught how to operate the machines and to keep them in order. Special attention is given to lathe work, where students turn chisel and hammer handles, rolling pins, table legs, balusters, and face-plate work.

First year: Names, uses, and care of tools; simple lessons in sawing, crosscut and ripping; nailing; exercises in planing rough surfaces to a finished face within one plane; exercises in joining edges at right angles to face, tested by the try-square; planing inclined and circular edges; making one-piece articles—sloid; turning-lathe practice.

Second year: Sharpening tools and setting saws; making halved joints, mortise and tenon; Russian sloid, doweling, dovetailing, and constructing joints from above principles at angles of 90°, 45°, 22½°, and 30°.

Masonry, Lathing, and Plastering.—The course in bricklaying with the other branches of the masonry department is designed to fit young men for practical life. Not only those who expect to be masons take instructions in this department, but also young men who are fitting themselves for master woodworkers and architectural draftsmen. The course of study is as follows: Names, uses, and care of tools; study of clay, sand, rock, and concrete; mortars and their constituent parts; foundations; practice work on straight wall; bonding, building plain window and door caps; lectures and practice work on arches; use of anchors; laying of pressed bricks; calculations on materials; estimating work; lessons in lathing; lessons in plastering, including all kinds of finish; lessons in estimating lathing and plastering. Lectures are given on strength of walls, fireproof construction, cement, etc. Instruction is given in drawing and reading plans. Students who are anxious to stand at the head of their work are encouraged to enter a class in architectural drawing.

Ironworking.—This department is fitted with eight portable iron forges of the most approved pattern, and with all necessary tools, vises, benches, etc. The course of instruction embraces the care and management of fires, and lessons in heating, holding, and striking, advancing gradually to bending, upsetting, welding, punching, drawing, and shaping iron, and hardening and tempering steel. Repairs are done by instructors and students, thereby giving practical training and application of theory. Shop tools are made by students in regular class work. Aside from forge work, finishing with files and emery cloth is taught. All work is executed from drawings made by students. It is the plan of the management to have machine work in this course another year. Arrangements are made for the placing of power lathes, drill press, and planer.

Painting.—This department is twofold in its instruction, comprising house and coach painting. Instruction is given in the following subjects: Use and care of tools; exercises in selecting colors and mixing paints; exercises in priming, second and third coat work in house painting; talks on pigments; exercises in sign writing; exercises in oil, wood filler, and varnish work; exercise in finish work; free-hand drawing of stencil patterns and cutting the same; graining and staining; fresco

painting in water colors and oil; exercises in gear and body painting, priming, puttying, pumicing, rubbing, striping, and finishing; glazing.

Printing.—The Claflin Bulletin is printed and the job work of the institution is done in the office. Students are first taught the boxes of the cases; to handle stick and rule, and to set and distribute type. They next learn the different fonts of type, to make up forms, and to do presswork.

Plain sewing.—All girls not members of the dressmaking classes are required to take plain sewing. So far as possible they are provided with material for the making of useful articles, but many are kept upon sample or practice work. There is no difficulty in keeping up an interest and even enthusiasm in this department.

Dressmaking.—By the system of dress cutting by measure in use any girl of ordinary intelligence can learn in one year to cut and make a dress in good style. Persons who are not members of the university are at liberty to learn the system by the payment of a small fee.

Cooking.—Classes in cooking are taught at the Simpson Home. The departments are furnished with the necessary implements and material to do plain cooking. The school has adopted in part the methods used in the public schools of Washington and in part the methods taught at Chautauqua. The outline is as follows: Cooking: Definition, purposes, processes, and incidental and general information respecting materials, sources, processes of preparing, and combination, care and selection of materials, care of ranges, fires, and cooking utensils. Processes: Boiling, stewing, broiling, baking, frying, and preserving. Boiling: Meats, vegetables, cereals, doughs, and liquids. Stewing: Meats, vegetables, and fruits. Broiling: Steaks, chops, fish, and oysters. Baking: Bread, meats, cake, pies, puddings, and vegetables. Frying: Fish, oysters, batters, and cakes. Preserving: By sugar, vinegar, and salt. Cooking for the sick: Meat soups and broths, cereal soups and broths, dainty dishes and relishes, cooling beverages.

The faculty numbers 33, of whom 8 are engaged in teaching industrial occupations. They are graduates of colleges, schools of technology, normal schools, etc. The number of students in the trades courses is as follows: Mechanical drawing, 190; architectural drawing, 14; woodworking, 108; masonry, lathing, and plastering, 175; ironworking, 50; painting, 10; printing, 8; sewing, 195; dressmaking, 30; domestic economy, cooking, etc., 26.

During the earlier years of the school it did not graduate, and since it has done so but 50 have been regularly graduated.

Since the original purchase of land and buildings but $10,000 has been expended on new buildings and $20,000 on equipment. A new industrial-training building is now under way, which will cost, when completed, about $30,000.

Much more is being done in industrial lines now than formerly, on account of recently increased facilities.

The cost of maintaining the university is about $8,000 annually, and the funds are raised by contributions from Northern people, as the result of personal solicitation, and an annual sum of $4,000 from the John F. Slater fund.

In the opinion of those conducting this institution, the trade courses taught are good, and no substantial improvement could be made except by making the industrial department more of a school of technology.

They state that the benefits accruing to industries as a result of the school training affect more than those existing in the locality, which are but few. Many of the students are from distant homes, and upon leaving the institution they carry their training and the habits acquired into their own localities, and do much good by example and teaching. There has been a decided improvement in the moral tone of students, and since the introduction of the industrial training in 1883 the discipline has greatly improved. The training of the school is said to have greatly increased the intelligence of those who have been under instruction. The graduates have no difficulty in finding steady employment and promotions come because of their good preparation. Employers prefer them to shop-trained workmen because they have knowledge of mechanical drawing, can carry out the instructions of architects, and make out estimates and bills for lumber, etc. They can also read drawings and plans. They can get work at any trade taught in the school without undergoing a period of apprenticeship.

STATE COLORED COLLEGE, ORANGEBURG, S. C.

This institution was established under the authority of an act of the legislature of South Carolina passed in 1896. There are in operation a college, a normal and preparatory school, a model school, a musical department, an art department, an industrial department, a mechanical department, an agricultural department, an engineering department, and a military department.

Those completing the courses in any of these departments will obtain a diploma, which is equivalent to a life certificate as a teacher in the public schools of the State.

Those applying for admission must be of sound physical health, bring testimonials of good moral character, have a knowledge of the ordinary branches of an English education, and must pass the required examinations.

Board in the college dormitories, including furnished rooms and washing, costs $35 per school term—$5 per month in advance. There is no charge for tuition, unless parents or guardians have an income of $1,000 per year. Cost of text-books will average $8 a year throughout the course. Each student is charged an entrance fee of $1, payable in advance, to provide for breakage, wear and tear, and incidentals. Each male student is required to provide himself with a military uniform, which costs from $8 to $15, and the female students uniform dresses of blue serge trimmed with black braid, which can be purchased at college at a cost of from $3 to $5.

It is the design of the industrial department to give training in such industrial arts as may be suitable to men and women and conducive to self-reliance and usefulness. This department teaches the following subjects: Sewing, dressmaking and millinery, cooking and domestic

economy, carpentry and woodwork, bricklaying and plastering, mechanical drawing, painting, ironworking and machinery, upholstering and cabinetmaking, saddlery, harness making, shoemaking, sawmilling and manufacture of hard and soft lumber, and tailoring. In addition to the above the agricultural department has a course in dairying and butter making.

Every student over 12 years of age must do two hours' manual labor per week under the direction of the president, who, in assigning work to any student, has due regard to the course of study pursued by that student.

For the school year 1899–1900 the number of students in the different trade courses was as follows: Sewing, dressmaking, and millinery, 251; cooking and domestic economy, 200; carpentry and woodworking, 78; bricklaying and plastering, 95; mechanical drawing and painting, 37; ironworking and machinery, 60; dairying, etc., females, 16, males, 25.

The total number of graduates since the establishment of the school to the year 1900–01 has been about 225. The faculty numbers 26, of whom 9 are engaged in teaching the above industries.

The college buildings and their equipment have cost about $100,000 and the annual cost of maintaining the institution is about $28,000. The necessary funds are given by the State of South Carolina and by the United States Government in the form of income from the State's proportion of land grant for the purposes of maintaining agricultural colleges.

The officers of this institution state that they believe the system pursued here could be improved by the addition of more trades to their courses, and that the outlook for their being able to do so is encouraging. Pupils attending the school have, in the opinion of its instructors, been benefited in every way—physically, mentally, and morally—and have received higher wages and steadier employment by reason of their school training.

It is the belief of the school authorities that graduates of such institutions are preferred by employers to merely shop-trained workmen on account of the thorough training they receive, and they state that the graduates in carpentry, bricklaying, tailoring, painting, and blacksmithing do not have to pass through any period of apprenticeship, but get work immediately upon graduation.

KNOXVILLE COLLEGE, KNOXVILLE, TENN.

Knoxville College is said to be the leading educational institution of the United Presbyterian Church for the colored race. It is under the control of the board of missions to the freedmen of the church, located at Pittsburg, Pa., and is sustained chiefly by contributions from the various congregations. It was opened in September, 1875, in East

Knoxville, Tenn., but was removed to Knoxville in 1876, when it was established as a college.

It was maintained for a number of years as a literary institution only, but the long-felt need of education in industrial lines led to the opening of an industrial department, and by an arrangement with the University of Tennessee the college has become the industrial department of the university for colored students. For this purpose the university has added largely to the equipment of the agricultural and mechanical departments, provides for the salaries of the professors of these departments, and sets aside $300 annually to pay for the labor of the students in the same. Free tuition is given State students, and they are assigned work in one of the industrial departments, if they desire it, and receive compensation in proportion to the work accomplished. They are thus enabled to earn a part of their expenses.

The courses of study offered are classical, scientific, literary, normal, theological, and industrial.

The industrial departments include agriculture, mechanics (including carpentry, iron working, electricity, and mechanical drawing), printing, sewing and dressmaking, and cooking.

The college has 115 acres of land and on this crops are raised, thus giving the students in agriculture a training in making the largest yield off a small acreage. Stock of various kinds is raised. With the aid of a foreman all the work on the farm is done by the students under the direction of the professor in charge. This enables them to receive practical experience in farming, and also to earn a part of their expenses. Twice a week lectures on agriculture are given by the professor in charge. The industrial building contains a laboratory fitted up for the special accommodation of students in agriculture. The design of this course is to make better farmers and create such love for farm life that young men will not be too ready to leave the country and go into the overcrowded cities.

The industrial building is equipped with a 25-horsepower engine, a dynamo capable of lighting 250 lamps each of 16-candle power, a circular saw, lathes, and work benches, with outfits of tools for work in wood. Students in this department pursue a regular course in woodwork, iron, and mechanical drawing. They are under the direction of a competent instructor and produce articles to be sold at the market price. They are made familiar with the use of tools, and taught how to care for them and how to keep them in order.

The electric-light plant is run entirely by the students and by it all the buildings are lighted. A steam-heating plant, also run by the students, heats the various buildings.

The facilities for becoming acquainted with the business of printing are good. A large cylinder press, run by steam, does the heavier work, such as catalogues and newspapers, while a job press turns out

programmes, letter heads, billheads, circulars, posters, etc., to meet the demands of trade. The work is under the direction of a practical printer, who teaches young men and young women not only how to handle type, but also to make up forms and operate the presses.

One large room is devoted exclusively to dressmaking. A teacher of practical experience superintends the work. Opportunity is given to students to acquire skill in cutting and fitting, provided they have had sufficient practice in the use of the needle. Persons who are not students in the college may take lessons by paying the same tuition as in the literary department.

Lessons in plain sewing are given daily to all the girls in classes from the second year primary to the eighth year training, inclusive. Lessons in dressmaking are given daily to all the girls in the normal and collegiate departments. The smaller boys, also, of the training school, sew. Pupils in classes below the fourth year training are given models which include all the stitches used in plain sewing. These models follow one another in regular order. Pupils who have not yet passed from the models make articles which include only such stitches as they have already taken up in the models. The sewing machine is used by a few who are most familiar with the use of the needle. All the work is done under strict inspection, and no garment is allowed to leave the room without examination by the teacher.

In addition to the regular cooking for the boarding department, all of which is done by the students under the direction of a superintendent, special instruction is given in a course of scientific cooking. The chemistry of foods, the principles of healthful preparation of food, courses in plain cooking, invalid cooking, and fancy cooking are taught in this department.

In the college year of 1900–01, for which the facts presented in this report were gathered, the number of pupils in each of the trade courses was as follows: Agriculture, 17; mechanical, 16; printing, 16; sewing and dressmaking, 68; cooking, 50. The total number of students in the college was 301. There have been about 200 graduates, but none in the industrial courses, as they have not been established long enough.

The general management is in the hands of the president and faculty, of which there are 26 members, 9 of whom are instructors in the industrial courses. There are 9 buildings, including, besides the dormitories and recitation hall, the president's cottage, a barn, a heating plant, and an industrial building. The college property, including buildings, grounds, etc., is valued at $110,000. The annual cost of maintaining the college is $13,000, which is obtained to the extent of $10,000 per annum from the church and $3,000 per year from the University of Tennessee.

Students are admitted at any time on certificate or examination. The State is divided into 33 senatorial districts, and each senator has

the privilege of appointing two colored students, male or female, to the State normal scholarships, so that 66 in all may be appointed, each for two years. The applicant must be at least 16 years old, and will receive $50 credit on board and tuition if in school eight months.

Necessary expenses are, for day students, $1 incidental fee per term and 50 cents tuition per term; for boarding students, board, fuel, light, room, and tuition (if paid a term in advance), $19.50 for each of the first and second terms and $19 for the third term, a total of $58; if not paid in advance, expenses are, incidental fee $1, and board, etc., $6.85 for each school month of four weeks. Students remaining through the holiday week pay $1.50 for the week. Five or six dollars more may be required for books, postage, stationery, and mending. Extra charges are made for instruction in music. With economy any student is able to remain during a school year for $70. Some by doing extra work manage to earn $10 to $30 during the year.

It is believed that an improvement can be made by enlarging the agricultural department. More land has been purchased, and a dairy is to be opened. More funds to be applied to industrial training are needed. Agriculture is the only industry in the locality of the school that has been benefited by its establishment so far. Graduates have built homes and own farms and cultivate them intelligently as a result of the school training. The example of the school has disseminated a healthful feeling, and manual labor is no longer looked on as disgraceful by the colored people in the locality of the school. In some instances those who have received the industrial training have, to the knowledge of officials of the school, been preferred by employers to shop-trained workmen.

WILEY UNIVERSITY, MARSHALL, TEX.

This institution was chartered in 1873 by the Freedmen's Aid and Southern Education Society of the Methodist Episcopal Church.

This school has a college department, a college preparatory department, a normal course, an English course, a theological course, special Bible courses, a department of music, and an industrial department. The industrial department gives instruction in printing, shoemaking, farming and gardening, carpentry, sewing, and dressmaking. Of the foregoing the trades of printing and dressmaking are claimed to be fully taught. During the year 1900-01 there were 18 pupils in printing and 50 in dressmaking. There have been 30 graduates in these two trades.

The faculty numbers 21, and of these 3 are employed in teaching the trades mentioned.

This school is open to the youth of the colored race of both sexes. Applicants for admission must bring evidence of good moral character, and no student under 14 years of age will be admitted except by special arrangement with the president.

Students upon entering the school must deposit with the president sufficient money to cover one month's expense. Expenses for boarding students: Boys—board, room rent, light, fuel, washing, and incidentals, per month, $10.50; girls, who may do their own washing in the laundry—board, etc., $9.50 per month. Expenses for day students: First and second grades, 50 cents per month; third grade, 75 cents per month; all other grades, $1.25 per month. Industrial department: Stenography, $1 per month; typewriting, $1 per month; stenography and typewriting when taken together, $1.50 per month; printing, 50 cents per month; shoemaking, entrance fee, $2. Graduating fee: College courses, $5; normal courses, $2.50.

The building used by the industrial department, with its equipment, cost $1,200, and the cost of maintenance is $900 per annum. The funds are raised by fees, subscriptions, and contributions from the Methodist Episcopal Church.

It is said that the industrial department could be improved by perfecting the courses and increasing the number of trades fully taught, and that the outlook is hopeful. There are but few industries in the vicinity of the school. Several of the graduates have gone out as dressmakers, cooks, printers, cobblers, etc., and are doing well. Most of them have located at a distance from the school and exert an influence for good. The work of printing and dressmaking has been greatly improved in the locality of the school, owing to the example of the methods taught therein. The systematic way in which the school graduates do their work causes them to be preferred by employers to other employees, and they are not obliged to pass through a period of apprenticeship.

ARMSTRONG AND SLATER MEMORIAL TRADE SCHOOL, HAMPTON NORMAL AND AGRICULTURAL INSTITUTE, HAMPTON, VA.

This institution was established by Gen. S. C. Armstrong, at Hampton, Va., in 1868. Its primary purpose was to give to young colored men and women who had emerged from slavery the right kind of instruction in good conduct, in the rudiments of book knowledge, and in the plain tasks that go with farming, the ordinary handicrafts, and the duties of home and family. There was also an imperative need of negro teachers in the county public schools who could show the people by example, as well as by precept, how to live and how to get land and build decent houses. With the advancement of the colored race more thoroughly equipped teachers were wanted, not only for public schools but for workshops, and for the industrial and agricultural schools that have started up throughout the South. In 1870 this institution was chartered by the general assembly of Virginia. It is not owned or controlled by State or Government, but by a board of 17

trustees, representing different sections of the country, and 6 religious denominations, no one of which has a majority. The more important matters of finance are referred to the executive committee of the board, and all endowment funds are cared for by the investment committee in New York City. All moneys from legacies are placed in the endowment funds, or, in rare cases, when unrestricted, used for permanent improvements. A board of curators is appointed by the governor of Virginia to report to the State on the use of $10,000, interest on one-third of the land-scrip fund of Virginia, appropriated to the school toward the agricultural and military training of its students.

In 1878 the institution was opened to Indians, and experience soon showed that their association with the young negroes was not only feasible but in many ways mutually beneficial. The United States Government has now for many years contributed annually toward the support of a considerable number of Indian boys and girls, averaging somewhere between 15 and 20 years of age. It maintains 120 Indians at the school, paying $167 per annum for each one, which sum meets the cost of board and clothing. From 10 to 20 more are educated here without expense to the Government.

Instruction in the school was at first academic and normal, and other courses have been added from time to time. Manual training formed a part of the regular instruction, but this kind of education was not sufficiently industrial. The fact was recognized that there was danger that the blacks would lose the trades, which were their best inheritance from slavery, unless industrial education was pushed; and it was also felt that a training in the trades must prove an inestimable advantage to the Indian in his effort to raise his standard of living and adjust himself to the changed conditions of his race. The regular teaching of trades was therefore taken up and a trade school opened in March, 1897, for which a special building was erected, called the Armstrong and Slater Memorial Trade School.

All trade-school students are required to devote nine hours each day to their trades and two hours to recitations in the night school. A certificate is given to each student who satisfactorily completes the required amount of work in any of the courses. The length of each trade course is three years. Tuition free of charge is provided for all deserving students, but payment for board, clothes, and schoolbooks is required in cash. Expenses are as follows: Board, including washing, fuel, light, and medical attendance and a limited amount of drugs, $10 per month; books, $5 in advance at the beginning of each school year. There is an opportunity, in the various industries carried on, for able bodied students to earn from $2 to $3 per month toward their board, but the school does not promise this in any case. The rate of wages varies according to the real value of the work done, and students' labor for pay is accepted only when satisfactory. Students

are required to purchase a school uniform, the cost of which is $13.50.

Students are liable to fine, reprimand, confinement, or other necessary punishment. Labor is required of all for the sake of discipline and instruction. Every student who enters the school agrees to submit to its discipline. The first year is especially probationary. Students may be sent home at any time for inability to keep up with their classes, for unsatisfactory conduct, or for bad influence over others. Courtesy and mutual forbearance are expected of all. Applicants for admission must be at least 16 years of age and must pass the required examinations. Sound health, testimonials of good character, and the expressed intention to remain through the entire course are required of all. Applications for instruction in special trades will be given due attention, but the desired trade can not always be granted at once.

The trade school offers courses in the following departments: Carpentry, painting, wheelwrighting, blacksmithing, machine work, tailoring, bricklaying, plastering, shoemaking, harness making, steam engineering.

The advantage of entering the trade school is that one can take up a trade by logical and systematic steps from beginning to end. Each department is free to teach fundamental principles; by the careful application of which to commercial work and by constant drill in the use of tools it is claimed the student has a far better chance of a well-rounded training than under the apprenticeship system.

In addition to the above there is great opportunity for experience in the various productive industries on the school grounds. These industries are directly under the control of the institute and are open to the trade-school students, who are expected, as a part of their respective courses, to spend in them a portion of their time. The trade school, through the munificence of its friends, has one of the best equipments of tools and appliances to be found in the country, and tries to carry out Hampton's underlying thought of providing such an education as will be a help not only to the individual, but through him to his race.

The following lines are followed in the trade courses: Actual work at the bench; instruction in the kinds, grades, and prices of materials used; mechanical drawing, which, as far as possible, bears on each trade; drill in competitive labor. The academic or night-school work required in connection with the training at the trades consists of drill in arithmetic, language, science, geography, history, penmanship, etc. The detailed courses in the different trades taught are shown in the following statements:

CARPENTRY.—Each carpentry student has a bench containing a kit of tools, the use and care of which he is carefully taught by exercises in planing, nailing, boring, sawing, gluing, making joints, etc. When a certain proficiency is reached, a house

or barn is erected, either inside or outside the trade school, and each boy has an opportunity to apply what he has learned to actual house construction in such exercises as laying off foundations, including running lines, setting batters, leveling and squaring; laying off, framing, and putting into place the framework of a house—as sills, studding, floor joints, plates, and rafters, including hip, valley, and jack rafters; closing in and exterior work—as sheathing, shingling, weatherboarding, putting on cornices, making and setting door and window frames, scroll and ornamental work, porch and piazza work, and step building; interior work—as laying floor, casing openings, making and hanging sashes, blinds, and doors, wainscoting, mantel work, stair work, including newels, rails, and balusters, laying out and constructing stairway; miscellaneous work—as fence building, truss construction, etc. All work is done from drawings. Lectures with incidental study are given on topics connected with the trade, as foundations, chimneys, trusses, moldings, hardware, painting and glazing, wood and other materials. An excellent opportunity is afforded to study the manufacture of lumber from the log to finish, as the institute owns and operates a large saw and planing mill with dry kilns and the various machines for the manufacture of building lumber.

Painting.—The room in which painting is taught is fitted up with twelve booths, each one of which represents a good-sized room. One side of each room is made up like the outside finish of a house, so that in every booth there is a chance to learn something of outside painting and calcimining. On the walls of the main room is ample space for brick penciling, stenciling, and other forms of decoration. The members of the paint class are allowed to supplement their training by work in the institute paint shop. From this shop they are sent out as regular painters to the various buildings, some sixty in all, that belong to the institute, a plan which provides as good an opportunity of applying the trade as could well be found. Enough is given in this course to enable the student to become an intelligent painter of houses, and instruction is given besides, to a limited extent, in graining, hard-wood finishing, calcimining, and frescoing. The theory of paints, their manufacture and adulteration, and lessons on the mixture and harmony of colors are given as time permits. Carriage painting may be taken, if desired.

Bricklaying and Plastering.—In this, as in the carpentry and painting courses, the greatest stress will be laid on plain house work, including foundations, walls, arches, and chimneys. The course of instruction in bricklaying includes the proper use of the ordinary bricklayer's tools; making mortar beds and boards, building scaffolds, screening sand, slacking lime, use of coloring material, selecting brick, choice of lime and sand, spreading mortar, use of cement, cleaning brick; brick pavement, laying foundations with footings, using bond rod, English and Flemish; use of stretcher, headers, halfheaders, rowlocks, and ties; laying piers, setting window and door frames; laying pressed brick front, trimming joints with pointing trowel and straightedge; laying off and building arches, square, banded, gothic, circular, and inverted; building chimneys and stacks, square, round, and octagon; ornamental work, terra cotta and tile work; laying drain pipes, culverts, wells, and cisterns; cleaning walls with acid; setting bake oven and boiler; fireplace work, and arched roof work, barrel and dome. In plastering the instruction covers making mortar and putty, use of hair, lathing, plastering walls and ceilings, plastering to grounds and to finish, scratch coating, second and third coating, floating, hard finish, sand finish, stucco work, and running cornice. Lectures include the general subjects relating to building, as in the carpentry course, and other topics especially connected with bricklaying and plastering.

House Building.—This course is arranged to combine a knowledge of carpentry, bricklaying, plastering, painting, metal roofing, and gutter work, and the courses of instruction are abridged from the respective departments in which the student is employed. This department is designed for young men who may wish to settle in

small communities where a knowledge of several different trades will be of benefit, or for those who wish to become contractors and who desire a general knowledge of the building trades.

Wheelwrighting.—This course is intended to fit one to be able to handle the work that is found in the ordinary country or city shop. The student is expected to be able to build a farm wagon or a plain carriage from beginning to end. An opportunity is given for a partial course in blacksmithing to go with this course, so that the student will know what is needed to properly iron up his work. It is well, too, for the wheelwright to know something of plain carriage painting, and an extra year in the paint shop is advised if it can be afforded. Instruction begins with the care and use of the general wheelwright's tools, in working out the common processes and principles of woodwork, following the course given in carpentry. There then follows the application of these principles in constructing the parts of a wheelbarrow, as handles, bars, legs, spokes, and rims, and putting the same together; laying out and making the parts of cart frames, as sills, standards, and rails; riveting and bolting together, laying out and making ribbed wagon body, framework, and panels; laying out and constructing wagon gear, including perch, head block, and axle bed, the platform gear, with futchels, bedpiece, splinter bar, spring blocks, and circle blocks for fifth wheel; carving scrolls on spring bars, side bars, and head blocks; making shafts, including bending; making cart wheel, including shaving spokes; working out rims; laying out and mortising hub, and putting the parts together. Exercises are worked out from drawings. Lectures and study on vehicles, wood, and other materials used, ironwork as applied to wheelwrighting, carriage painting and trimming, and other topics connected with the trade.

Blacksmithing.—Instruction is given in the care of fire, the best fuels, proper heat; care and use of the general blacksmith's tools, including the working out of the following processes: Drawing out, upsetting, bending, twisting, punching, cutting off, squaring up, scarfing, welding, brazing, casehardening, tempering, annealing, heading and threading bolts, making and tapping nuts, riveting, hack sawing, tire setting. These processes receive further application in forging staples, gate hooks, hasps, anchors, cleats, hammers, eyebolts, collars, chains, punches, wheel tires, springs, general carriage work, lathe tools, and horseshoeing. Work is done from drawings as far as possible. Lectures on such topics as combustion of fuels, construction of metals, strength of materials, tempering and annealing, arrangement and equipment of shops, power forging, tracking of wheels, artistic forging, specifications, and estimates.

In addition to the above a department of scientific horseshoeing has been added and each student before he can finish his trade takes his turn at this work. The course in horseshoeing covers the following ground: Stripping and preparing foot to receive new shoe and nailing in place to give correct lines to agree with pastern and leg; making shoes from horseshoe iron, and special shoes to overcome difficulties with the feet, such as corns, quarter cracks, contractions, etc.; study of diseases of the feet and remedies which can be suggested through good shoeing; shoeing to overcome difficulties in the gait, such as interfering, kneeknocking, stumbling, etc.

Machinist's Trade.—The course of instruction in the machine shop is as follows: Vise work: Instruction will be given in laying out work to drawings and in the proper use and care of tools, as the chisel, square, file, scraper, and hack saw. The exercises include cape chiseling, broad chiseling, roughing out with file, filing to a line, draw filing, finishing, squaring up, polishing with file and emory cloth, hack sawing, bolt threading, nut tapping, scraping, plane-surface fitting, slide fitting, riveting, key-way cutting, tool making, as dividers and calipers. In addition to the above, each student is given some instruction in forging chisels, lathes, and plane tools, annealing, and tempering. Special lathe work: This includes small drilling, tapping, knurling, filing, and polishing. A course is given in hand tool work, such

as small screws, thumb nuts, binder posts, and handles. Drill press work: This includes drilling to given depths, blocking out with drill, center drilling, countersinking, counterboring, etc. Shaper and planer work: Cutting off work, planing to dimensions, squaring, inside work, bevel planing, inside keyway, planing T slots, and work requiring the use of surface gauge. Lathe work: Proper use of the lathe, straight cutting, shoulder cutting, tapers, eccentrics, chuck and face plate work, cutting thread (inside and outside), use of boring bar, polishing, use of center rest. Care of tool room: The check system is used in issuing tools and the students take turns in the care of this room, which includes keeping the tools in order. Repair work: The greater part of the repair work from the saw and planing mills and from other departments on the grounds is done by the students, which gives an excellent opportunity for practice. New work: A speed lathe and emery grinder have already been built by students. Also many new tools, jigs, and special machines. This year it is expected that a small marine engine will be built, besides some other special tools.

Steam Engineering.—This course embraces (1) care and management of boilers, including building, stoking, drawing, and banking fires, regulating draft, water supply, and steam pressure, using injector, inserting water gauges under pressure, blowing flues, scraping or cleaning tubes, safety-valve adjustment, patching and calking boilers, inserting and expanding boiler tubes, packing valves; (2) practice in running and caring for engines, making steam connections, setting slide valve, giving proper lap and lead, setting eccentric, arranging for the proper cutting off, filling oil cups, speeding governors, fitting belts, lining up, taking indicator cards, and calculating indicated horsepower. This course is intended to fit men to run boilers or engines in connection with mills, electric-light plants, farms, etc.

Harness Making and Carriage Trimming.—In this course students are taken through the processes or steps leading to the making of various kinds of harness and to carriage trimming, following which application of the processes is given on harness and carriage work. Instruction and practice are given in making threads, cutting, skiving, and rounding edges of strap, punching, putting on loop and buckle and stitching same, making simple parts of harness, as hame strap, breeching strap, and girth; making folded bodies, including making and using patterns in cutting lays, stitching, straight and figured creasing, skiving and sewing up waved and straight raised lays, applying these in breeching, girth, breast collar, lacing in soft cheek loops, etc.; practice in saddle work—as in express, buggy, or couple harness, using tree, cutting skirts from patent or harness leather or cloth, covering reed and binding saddle, stuffing with hair, tufting, stitching, putting in billets and terrets; practice on round work such as gag, face, and winker rounds, round hip strap, trace, rein, and bridle; practice in cushion work, trimming shafts, leathering dashers and fenders, making falls, lazy back cushions, etc., work on buggy and extension tops, carts, saddles, and other harness and carriage work; lectures and study on leather, kinds and styles of harness, drafting harness, estimating cost, etc.

Shoemaking.—In this course practice and instruction are given in the steps leading to the production of a shoe, as follows: (1) Making waxed ends, using bristles, proper position for stitching, use of the awl, practice in sewing, cutting, skiving, and putting on patches with cement, nailing and pegging soles, sewing welt to upper, sewing sole to welt, using sewing machine in stitching upper leather, putting in lining, punching and putting eyelets and hooks, taking old shoes apart, learning the names of parts and the methods of putting them together, practice in cutting lifts and soles, making rands, welts, and counters, finishing edge, sandpapering, buffing and coloring soles, lasting (using slips for upper); (2) cutting uppers by pattern, stitching, lasting, bottoming, and finishing a pegged shoe of ordinary grade; (3) measuring foot, fitting last, developing patterns, selecting stock—as upper, soles, counters, felt, thread, etc.—cutting out stock, and making sewed shoe to measurements.

TAILORING.—Applicants for this trade will take up the work as follows: *First year:* Technical work in sewing; free-hand drawing; the study of woolens, with occasional talks on business methods and etiquette.

Second year: Sewing, free-hand drawing, the study of fabrics, study of the cost of garments, practical examples in estimating materials and cost of suits, study of the form, drafting by regular measurements, alterations.

Third year: Test of the student's executive ability, and special practice and instruction in the details of running a successful business. Practical talks are given from time to time in regard to the purchase of goods. During this year as much productive work as possible is given the student.

The following is a list of some of the details of the course: Correct position of the workman, proper method of threading needle, position of needle and thimble while sewing, practice in machine running, care of machine, stitching used in making a suit of clothes—as plain basting, close basting, seaming or full back stitch to one sixteenth, side stitch, felling stitch, serging, herringbone, feather edge, making buttonholes, cord, flat, round, and feather edge, sewing on buttons of different kinds, as the neck, eyelet, and flat face.

Application of these processes is given in parts of garments. First, practice on parts of pantaloons, such as hip pocket, side pocket, top pocket, watch pocket, button fly, buttonhole fly, waistband, straps, turning up bottom, filling in parts of the trimming, seat lining, protection in the bottom, front buckle, pressing, shrinking, and taking out suppressions. These principles are applied in making a pair of pantaloons. Application is then given of the simple processes in the parts of a vest, as in making welt, patch, and faced pocket, putting in stiffening, stay tape to hold front, making and putting on collar, back strap, and buckle, joining back and front, after which a vest is made. Application of processes follows in parts of a sack coat, as flaps, cash and ticket pockets, breast pockets, inside and outside, putting in canvas, stay tape, sleeve vent, and cuffs, fitting trimming, fitting sleeve and adjusting fullness, regulating looseness of lining, padding, springing of shoulders, and pressing of seams, top and bottom collar, stitching around edge, and necessary pressing. These principles are then applied in a sack coat. In repair work practice is given in patching, darning, splicing, inserting round, square, and triangular patches to match stripes, putting on braid, half and half, flat and cord, scrubbing, cleaning, pressing, and sponging. Taking measurements and drafting garments are associated with the training. This includes the use of straight and curved lines and the fitting of ends and notches to secure the correct results.

MECHANICAL DRAWING.—The course in mechanical drawing is given as a part of the training of all trade students. Tailors, shoemakers, harnessmakers, and painters have free-hand drawing in addition. The drawing is arranged with a view of giving the student a general knowledge of working drawings, preparing him to interpret intelligently drawings placed before him, and to cultivate his ability to make working drafts, plans, elevations, and sections of tools, buildings, machines, wagons, and other work in the line of his trade, and to build according to the same.

The course comprises the study of projection, plans, elevation, and sections; practice in free-hand sketching (projectives); spacing and drawing straight and curved lines; making joints between straight lines, between straight lines and curves, and between curved lines; making block letters; geometrical problems; drawing plans, elevations, and sections from the object itself, from other drawings, and from memory or original design; getting out bill of materials and estimating cost of some pieces of work actually done; designing and estimating.

CABINETMAKING.—The course in cabinetmaking is open to a limited number of applicants who can show special need and aptitude for this particular trade. The first year is spent in going through the principles of carpentry and joinery. Then follows a course in wood turning, wood carving, study and design of furniture, repair-

ing of furniture, and the actual construction of cabinets, tables, bookcases, etc. French polishing, staining, and finishing of woods are also introduced. It is in general understood that a student entering one of the above trade-school courses will confine himself to his particular line of work throughout the course. Legitimate combinations of the various courses are permissible when approved by the officers of the school. For instance, wheelwrighting and blacksmithing are combined; also, harness and shoe making, and carpentry, bricklaying, plastering, and painting.

In addition to the trade-school courses, other courses teaching trades or occupations are given in the institution as follows: Course in electricity, aimed to prepare handy workers at the art; courses in tinsmithing and printing in connection with the school industries; courses in sewing, cooking, and laundry work for girls who wish to learn these trades; courses in agriculture, horticulture, and dairying. The detailed description of many of these courses follows:

Electrical Course.—A technical and practical course in the useful applications of electricity comprises wiring for electric bells, lights, etc.; construction and management of telephones, dynamos, and motors; management of small electric plants; electrotyping and electroplating; telegraphy; construction and repair of electrical devices in general use. The apparatus of this course includes the electrical instruments, devices, etc., which are found in daily use. The physical laboratory is furnished with a complete electrical plant.

Tinsmithing.—Instruction is given in the care and use of tinner's tools, working out the processes entering into general tin work, as roof covering, conveying of water, manufacture of tinware, setting up stoves, and pump work. It includes pattern cutting, folding on break, soldering, riveting, brazing, burring, double seaming, forming on rollers, hand seaming, beading, bending, and mitering. Enough practical work is found on the school grounds to give good drill in the many applications of the tinner's trade.

Printing.—Applicants for this trade must pass the examination for entrance to the middle class. Instruction and practice are given in presswork, including making ready and running jobs on small job press; at the case in plain composition—as learning cases, sizes, and faces of type, proper position for holding composing stick, setting type, justifying, emptying stick, and putting on galley; leading, arranging in chase, locking up, proving and correcting proof, cleaning and care of type, distributing dead matter, etc., reading proof, making ready and running cylinder press; check and order book binding, book composition, and imposition. Application of these principles is given in the varied work of the printing office, as setting and printing note heads, billheads, circulars, envelopes, posters, bills of fare, tabular work, blanks, color work, tablet binding, etc. Lectures, reading, and study include topics connected with general printing, as stereotyping, electrotyping, various processes of cut making, estimates, stock, etc.

Instruction in the several agricultural courses is given by means of text-books, lectures, and practice work; class-room work is illustrated by means of specimens, models, charts, photographs, etc. As far as possible each student is required to put in practice the principles taught in the class room. Students taking the courses in agriculture are required to put a certain number of hours each week into recitation, study, drawing, and practice work.

Practice is an important and prominent feature of the course, and for pure practice the student receives no wages. After meeting the

requirements as to recitation, drawing, practice, etc., the student is given an opportunity to do necessary work in the department, and is paid according to his ability and the actual time spent in doing the work, being thus enabled to earn something toward paying for board and incidental expenses. Tuition is free.

Twenty acres of land have been devoted especially to practice work. Four acres of this have been laid out as a small model farm. Ten acres have been planted with small and orchard fruits and the remainder is used for experiment and illustration in the growing of farm, truck, and garden crops. In the new domestic science building the department of agriculture has six large rooms, a museum and lecture room, a laboratory for chemistry and physics, a laboratory for botany, horticulture, and entomology, a farm laboratory, a dairy, and a farm engineering room. The department has also two greenhouses. Aside from these the institute has two large farms, which together cover about 700 acres, equipped with buildings, dairy stock, horses, hogs, and poultry.

AGRICULTURAL COURSE NO. 1.

This course covers a period of three years and is intended for students who wish to fit themselves to be agricultural teachers and superintendents.

The course is as follows: Theoretical chemistry of the nonmetallic and metallic elements. Chemistry of soils, plants, animals, manures, and fertilizers. Laboratory work on the preparation and properties of the nonmetals, qualitative separation of the metals, and quantitative tests of simple minerals, salts, dairy products, and fertilizers. Structure and habits of growth of the crops and weeds of the farm. Insects injurious and beneficial to agriculture. Farm management, farm buildings, fences, roads, repairs, etc. Farm accounts, business forms, etc. Origin and physical properties of soils, tillage, manures, rotation of crops. Farm drainage. History, uses, and culture of various farm crops; modification of plants by soils, climate, and culture; propagation of plants. Gardening and trucking—soil, variety of crops, culture, market, etc.; forcing vegetables under glass. Propagation, planting, pruning, care, and marketing of orchard and small fruits. Floriculture, ornamental gardening. Care, management, and breeds of dairy stock, horses, swine, poultry, and sheep; composition of feeding stuffs; principles of stock feeding; principles of stock breeding; diseases of live stock. Dairy stock—breeding, care, management. Dairy bacteriology. Milk—composition, sterilization, pasteurization, care, testing, creaming; ripening the cream, churning, working, packing, and marketing the butter. Cheese making. Dairy utensils—separator, churn, butter workers, cream vats, etc.

Elementary agricultural course.

This course is required of all students who take the academic course.

Junior year: An aggregate of five months during fall and spring are devoted to introducing the pupils of this class to plant life, soils, and insect life. The object of the work is to arouse an interest in nature and to teach some facts which are useful on the farm. The following is a brief detail of the topics studied: Plant life—principal parts of plants and the use of these parts to man; how these parts grow and what they do for the plant; conditions necessary for each part to make its best growth and to do its best work for the plant and for man; how to bring about these conditions on the farm. Soils—relation of soils to plants; sand, clay, humus; how

soils are made; work of sun, water, ice, air, plants, and earthworms in making soils; soil conditions which affect plant growth; relation of soil to water, heat and air; plant food in the soil; how to bring about and maintain soil conditions which favor plant growth. Insect life—general structure, metamorphosis, and habits are studied in grasshoppers, squash bugs, beetles, flies, bees, moths, and butterflies; the habits of other insects common on the farm are studied as they are found during field excursions. These three divisions of the subject are not taught as separate and distinct topics, an attempt being made to impress the student with the close relations existing between them and the interdependence of each on the others. The work is conducted by observation and experiment in field and classroom, by written exercises, and by discussions.

Middle year: Farm manures—barnyard manures, composts, green crop manures. Commercial fertilizers—sources of nitrogen, sources of phosphoric acid, sources of potash, sources of lime. Plows and plowing, harrows and harrowing, rollers and rolling. Seed planting, seed testing, transplanting. The after cultivation of crops, tools and methods. Soil moisture, relation to plant growth, conservation. Rotation of crops, its desirability, benefits derived, systems of rotation.

Senior year: The course of this year is partially elective. Students, acting under the guidance and advice of the faculty, are permitted to choose three, or not more than four, of the following subjects: Plant diseases, their nature, causes, and prevention; injurious insects, their nature, methods of destroying plants, insect remedies; dairy; breeds, care, and management of poultry, sheep, and swine; principles of stock feeding; principles of stock breeding.

For the benefit of those who are unable to spare the time for the three years' course in agriculture, shorter courses in agriculture, horticulture, and dairying have been arranged as follows:

AGRICULTURAL COURSE NO. 2.

Length of course one year, as follows: English branches as taught in the academic course. Mechanical drawing. Manual training. Chemistry of soils, plants, animals. Soils, origin, physical properties, tillage. Drainage. Manures and fertilizers. Farm crops, history, uses, culture. Breeding, selection, management, diseases, principles of feeding of farm stock, feeding stuffs, soiling of stock. Farm accounts, business forms, etc. Barns, stables, silos. Farm management.

HORTICULTURAL COURSE.

Length of course one year, as follows: English branches as taught in the academic course. Mechanical drawing. Manual training. Structure and habits of growth of plants. Modification of plants by soil. Propagation of plants by seeds, cuttings, grafting. Gardening and trucking, soils, varieties, crops, culture, marketing, growing vegetables under glass. Orchard and small fruits, propagation, planting, pruning, spraying, care, marketing. Floriculture. Ornamental gardening.

DAIRYING COURSE.

Length of course one year, as follows: English. Mechanical drawing. Manual training. Breeding, care, management of dairy stock. Dairy bacteriology. Milk—composition, sterilization, pasteurization, care, testing, creaming. Ripening the cream, churning, working, packing, marketing the butter. Cheese making. Separator, churn, butter workers, cream vats, etc.

The trade school offers to boys from 10 to 17 years old, who live in the immediate vicinity, instruction in the following trades during the

months of July and August: Manual training, carpentry, blacksmithing, wheelwrighting, and shoemaking. The students in these classes work from 9 until 12 every morning in the week except Saturday.

It is not expected in this summer course to turn out finished workmen, but it is hoped that the instruction will lead up to the taking of a full trade as a regular student, and that incidentally much useful knowledge will be acquired.

In addition to the regular teaching of trades and occupations as cited, an opportunity for work and practice at certain trades is provided in the department of productive industry. This department is conducted as a business enterprise and includes industries, open to students who have passed a year in the trade school or training department, as follows: A wheelwright and blacksmith shop; a tin shop; a tailoring department; a shoe shop; a harness shop; a paint shop; a machine shop; a bricklaying and plastering department; the Huntington Industrial Works, including a sawmill and lumber yard, a planing mill, and a carpentry and cabinet shop; a carpentry and repair shop; the normal school press; the engineering department; farming; the sewing and furnishing department; housework, etc.

These industries afford the opportunity of learning how productive industries are managed, of making practical application of the principles learned in the trade school, and incidentally of earning wages. Details of these industries are as follows:

The wheelwright and blacksmith shop, with its two departments, is engaged in manufacturing carriages, wagons, and carts for the school and for local trade, in general repair work, and in horseshoeing. The wheelwright department has an outfit of general wheelwright tools and benches, and employs about 8 workmen.

The tin shop has charge of the general tin and stove work connected with the institution—as the making and repairing of utensils, laying and repairing tin roofing, making and hanging conductors, making stovepipe, setting up stoves, and other shop and general outside repair work.

The tailoring department employs about 20 students. It furnishes the uniforms of the cadets, manufactures citizens' suits for school and outside trade, and does custom work in general, making yearly upward of 1,500 garments. It also does scouring, pressing, repairing, and similar work for the school and for the outside trade, also the designing of patterns.

The shoe shop is engaged in the manufacture of handmade shoes, both work shoes and fine grade, pegged and sewed, for the school and for the outside custom trade, and in general repair work. It employs about 9 students and has the ordinary outfit of tools and appliances.

All the harness work of the school is done in the harness shop, including repairing and making new harnesses for farm work, driving, etc. Harnesses are also made to order for outside customers, and repair work is done for the public generally. Carriage trimming, as it is included in carriage repair work, is also done. The shop has the usual supply of tools and appliances and employs an average of 5 men.

The paint shop does all the painting connected with the 50 buildings on the premises, both exterior and interior work, calcimining and paper hanging; also the painting and finishing of the product of other shops, as carts, barrows, agricultural implements, furniture, sign painting and lettering; upholstery work on chairs and other furniture, mattresses, and the like. Employment is given to about 10 men.

The machine shop employs about 8 or 10 students and carries on a general repair and jobbing business for the other departments of the school, and the surrounding community.

All repairs to brickwork, setting boilers, repairing flues, and bake ovens, making and laying of granolithic walks, plastering old or new buildings, comes under the bricklaying and plastering department. About 10 or 15 students are employed. This year (1900) they are to lay nearly a million bricks in the addition to Virginia Hall, one of the largest buildings on the school grounds.

The above industries, except tinsmithing, are carried on in connection with the regular trade-school department, and are managed by the teachers of the same.

The Huntington Industrial Works comprise three departments—the sawmill and lumber yard, the planing mill, and the carpenter and cabinet shop. The sawmill is equipped with a band saw, steam feed and conveying rolls, and automatic trimmer and sasher; it employs about 25 men, and saws annually 6,000,000 feet of lumber. This is brought to the mill in rafts, and after sawing is kiln-dried and shipped to various markets. The planing mill, with its equipment of saws, planers, matching and molding machines, is engaged in the manufacture of moldings, flooring, ceiling, siding, and other house finishings, for the general market, and employs about 15 men. The carpenter and cabinet shop employs about 20 workmen, and is engaged in the manufacture of window and door frames, sashes, doors, mantels, scroll work, and other interior and exterior finish, stair work, and cabinetwork, chests, bookcases, tables, etc. It has an equipment of lathes, circular, jig, and band saws, buzz and pony planers, boring, mortising, and tenoning machines, cabinet benches and tools. Yellow and white pine, poplar, and hard woods are used.

The carpenter and repair shop is supplied with general carpenters' tools, circular and small saws, upright molder, and mortising machine, and employs about 20 workmen. It has charge of the general repair work of the buildings, of which there are upward of fifty, and of the furniture connected therewith; manufactures new work, as easy chairs, desks, tables, and other cabinetwork, and does a portion of the new building.

The normal school press has charge of all the school printing, as letter heads, envelopes, circulars, catalogues, outside job work, two monthly publications, and one weekly paper. The equipment consists of two cylinder presses, two job presses, a lever and steam cutter, perforator, stabber, card cutter, and wire-stitching machine. It employs about 20 men.

The engineering department has the care of the steam plant for furnishing the steam for power and heat, also of the water supply. It includes the management of nine boilers, the running of three large and four small engines, the heating of three dry kilns and nearly all the buildings on the premises, the running of the steam pumps connected with the water supply and sewerage, and the laying of water and steam pipes in both new and repair work. It employs an average of 17 men.

The land under cultivation comprises about 700 acres—100 at the school farm and 600 at the Hemenway farm, 5 miles distant. Corn and oats are the principal crops, with some hay and potatoes and other vegetables. The farms are stocked with 130 cows, 40 to 50 young cattle, 40 horses, and several hundred hogs and poultry. The product of butter, milk, and cream from the dairies is used in the school and supplies the local trade. Products from the greenhouse are largely shipped away, as are also other surplus products. Modern buildings, machinery, and appliances are in use at both farms.

The sewing and furnishing department supplies all the bed and table linen, towels, etc., needed by the school, and fills orders for shirts and underwear for the young men and for gymnastic suits, cooking aprons, etc., needed by the young women. It employs about 15 seamstresses on full time.

Besides the work furnished incidentally in the previously-named industries to students working for a credit balance, employment is offered both to young men and young women in the various household departments and offices. Young men are employed as waiters, cooks, and helpers in the dining rooms and kitchens, janitors, laborers about the grounds, orderlies, etc. Young women can find work in the care of rooms and corridors, and in the large steam laundry, where the weekly wash of the whole institution is done and where the clothes of the young men are mended.

The general management of this institution is in the hands of the principal and a faculty of 10 members, under the control of the board of trustees.

The number of instructors teaching trades or occupations is as follows:

The Armstrong and Slater Memorial Trade School	12
The electrical department	1
Tinsmithing	1
Printing	1
Agriculture, etc	2
Department of domestic work	9
Total	26

All told, there are over 80 instructors in the institution, many of whom are graduates of normal schools, graduates of agricultural colleges, polytechnic schools, and trade schools. In the department of productive industries the number of managers of shops, etc., is as follows:

Huntington Industrial Works	4
Carpentry and repair shop	1
Paint shop	1
Printing office	1
Tin shop	1
Home farm	1
Hemenway farm	3
Total	12

For the year 1899–1900, for which the facts shown in this report were obtained, the number of students in the different courses in the trade classes was as follows:

ATTENDANCE IN TRADE COURSES, HAMPTON NORMAL AND AGRICULTURAL INSTITUTE, 1899–1900.

Trade.	First year.	Second year.	Third year.	Special courses.	Total.
Blacksmithing	12	6	5	10	33
Bricklaying	1	5	3	3	12
Carpentering	9	9	5	14	37
Engineering	5				5
Harness making	2		3	2	7
Machinists	9		3	4	16
Painting	2		2	5	9
Shoemaking	2	2		2	6
Steam engineering	4			3	7
Tailoring	13	7	1		21
Upholstering			1		1
Wheelwrighting	6	5	5	3	19
Total	65	34	28	46	173

The number of graduates since the establishment of the school in all its departments is 1,061. From these it is impossible to separate the number of graduates in the trades. The cost of buildings, equipment, etc., has been $757,000, which includes the land, having a valuation of about $30,000. All of the buildings of recent construction are especially adapted for the purposes for which used, and were chiefly erected by the labor of the students under the direction of the instructors. One of the buildings now in process of construction, which will cost upward of $40,000, is being built under the superintendence of one of the teachers, and the work of bricklaying, masonry, carpentry, painting, steam piping, etc., is being done mainly by the students. The total annual cost of maintaining the institution is about $150,000. The necessary funds are raised from contributions and donations of individuals, churches, etc., from one-third of the income of the land-scrip fund of Virginia, amounting to $10,000 annually, from money received from the United States Government for the education of 120 Indians, at $167 each per year, etc.

According to the officials of the school, while some benefits have accrued to the industries of this locality as a result of the establishment of the institute, graduates engaging in trades, commercial enterprises, and obtaining remunerative employment at the shipyards in Newport News, yet the primary object of the institution is broader and aims to benefit the races represented. The students not only fill responsible positions at the trades learned, in their distant homes, but are able to instruct others of their race in the industrial and technical subjects in which they have received instruction. Schools of this class have resulted in increasing the intelligence of many in the community, have enabled their graduates to obtain homes, and have also promoted the social, industrial, and educational development of their localities. Hampton Institute has been a great power for good in the community. The effect upon those who have attended these schools has been excellent in every respect—mentally, morally, and socially. They have received better wages in their trades than would have been possible for them to obtain without such study and training. Under equal circumstances the graduates of these schools are preferred by employers over merely shop-trained workmen.

The influence of the school has been to raise the standard of workmanship and skill in the shops of this locality. Its graduates are employed at nearly all the trades taught, without having to undergo a previous period of apprenticeship. Schools of this character in the South have generally proved satisfactory, and every effort is being made in every line to make them more thorough and complete, and they are fast attaining the end for which they were established.

ST. PAUL NORMAL AND INDUSTRIAL SCHOOL, LAWRENCEVILLE, VA.

This school is located at Lawrenceville, a small town midway between Norfolk and Danville, Va. It was established in 1888 by the present principal, Rev. James S. Russell. Its object is said to be to educate the head, hand, and heart by giving the students a thorough, practical training in the various industrial arts in connection with a thorough English education.

This school has normal, academic, and industrial departments. Those admitted to the school must be in sound health, must express an intention to remain through the course, and must present testimonials of good moral character. Tuition is free.

Students are divided into two general classes, day-school and night-school students. The night-school students are again divided into two classes, work students, who expect to do work for pay in order to help meet their expenses, and trade students. All boarding day students must pay $50 per session of nine school months, and for that amount they are furnished with board, washing, bed, room rent, fuel, lights, three sheets to each bed, two pillow slips to each pillow, one chair for each student, two pails, one broom, one and two tables, one lamp complete, and oil twice a week for each room. Work students pay an admission fee of $5 to cover medical and other fees for the session. Some students are allowed to work one day in each week for pay and to pay only $4 in money per month to meet their expenses. This number has to be limited, and is usually filled several months before the session opens. Day students living in the community must pay $5 per session. An average of at least one hour's work per day is required of all students, except that day students may purchase exemption by paying the sum of $5 per session. All work done by students, except the average of an hour per day, is credited on their monthly accounts. Graduates are charged $2 each for diplomas.

Trade students pay an admission fee of $5 to cover medical and other fees for the session, and are in addition required to deposit a fee of $5 as evidence of their intention to complete their trades. This latter sum is returned to the student at the end of the first year, less any charges which may be made for waste of material and fines which may be imposed for neglect of duty. Wages in the trade department are allowed according to the ability of the student and the kind of work done. The utmost economy is expected from the trade students in order that they may accumulate money for their expenses for at least one year in the day school. A portion of the earnings of students is held as a bond for the fulfillment of their purpose of getting an education at the school, and if they are expelled or leave without permission they relinquish all claim thereto.

Students who take the trade courses and attend the night school during the term of their trades are required to attend the day school the following year, working at their trades at least one hour each school day and Saturdays. This is done with the hope of graduating trade students from the normal as well as trade department.

The trades taught are: Dressmaking, tailoring, sewing, domestic service, cooking, laundering, farming and gardening, machinist's trade, architectural and mechanical drawing, painting, tinning, shoemaking, plumbing, printing, bricklaying and plastering, harness making, carpentry and joinery, wheelwrighting, cabinetmaking, blacksmithing, sawmill and gristmill trade, and dairying. Details of some of these courses are as follows:

Domestic Science.—All young women connected with the school take two lessons a week in plain sewing and cooking, whether making a specialty of this branch of work or not. Members of the cooking classes during class hour wear a cooking uniform, which consists of caps, aprons, oversleeves, and print dresses. Talks are given on promptness, neatness, cleanliness, and order.

Cooking.—*First year:* Elementary work, measuring, care of kitchen and fire, composition of food, combination of food, theory and practice work in plain cooking, which consist in cooking eggs, meat, fish, soup stock, soup, macaroni with cheese, rice, potatoes, soft custard, cornstarch mold, soft doughs, baking-powder biscuits, shortcake, apple dumplings, yeast bread, baked apples, broiled steak, broiled lamb chops, beef stew, gravy, vegetables, cream sauce, griddlecakes, gingerbread, cookies, plain cake, tapioca pudding, tea, coffee, cocoa; examination.

Second year: Grouping of food materials, nutritive value and cost of food, practice work in mere cooking, theory, adaptation of food to age, climate, and occupation; corn, lima beans, succotash, canning and preserving, creamed salmon, scalloped salmon, apple sauce, apple jelly, apple snow, baked heart, smothered beef, roast meat, hash, tomato sauce, plain suet pudding, fruit suet pudding, lemon sauce, foamy sauce, pastry, doughnuts, candies, orange baskets, frosting, Spanish cream, vanilla cream, ice cream, chocolate ice cream, strawberry ice cream; examination.

Hand Sewing.—Method of threading needle, making knot, using thimble, and the length of cotton to be used in the different varieties of sewing; talk on the needle, scissors, thimble, cotton, wool, silks, and flax; different materials; muslins, linens, cambrics, lawns, nainsooks, and other fabrics; basting, overhanding, backstitching, felling, stitching, overcasting, gathering, stroking gathers, and putting on bands, and which way bands must be cut, making buttonholes, eyelet hooks, and sewing on buttons, putting in gussets, herringbone and different fancy stitches, turning down hem by measure, and when to use a mitered corner, hemming and running French fell, hemstitching, and darning. After a student has completed the models she is expected to measure, cut, and make a suit of underwear; examination. Pupils must provide for themselves a workbox or basket for their sewing articles, which must contain a pair of scissors, buttonhole scissors, tapeline, needles, thread, and darning cotton.

Laundering.—The course is intended to give each young woman in the school a knowledge of laundry work for use either in her own home or elsewhere. The work is as follows: Chemistry of making cold and boiled starches; assorting and putting clothes in soak; how to wash body, bed, and table linen, flannels, silks, laces, muslins, ginghams, prints, sprinkling, folding and ironing; examination.

Dressmaking.—This class is designed to instruct those who have a knowledge of hand and machine sewing. Lessons in taking measure; lessons in drafting a tight-

fitting basque; basque with two underarms; lessons in tracing and cutting out materials; lessons in basting seams and joining the different parts; matching plaids, striped and figured materials; stitching and pressing a waist; boning and binding seams; putting on collars; putting sleeves in waist; trimmings, etc.; examination; instruction on combination of colors, on choice of material, making and hanging skirts, lining and interlining skirts, making various kinds of trimmings for skirts, etc.; talks on form.

AGRICULTURE.—Practical farming and gardening have been carried on by a number of young men with fairly satisfactory results. Facilities for instruction and practice, embracing implements, stock, and material, are being added from time to time, until this department becomes well equipped. The school owns 1,700 acres of land, about one-eighth of which is in cultivation, the rest being in pasturage and wood.

HORTICULTURE.—The course includes the consideration of seed, its germination, the nutrition of plants and their development from the seed to maturity; how plants are affected by heat, cold, moisture, dryness, parasites, soil, climates, etc. Attention is given to transplanting, pruning, use of spraying pumps, the compounding of insecticides, and fungicides; the making of hotbeds, cold frames, tree protectors, and berry boxes; also the cultivation, preservation, and making of the various fruits and vegetables of our climate; the principal injurious insects and the methods of preventing their ravages.

In the trade courses the instruction follows the same outline as at Hampton Institute, which has been previously given.

Special attention is given to the training of domestic servants, and this is not confined to students only, but young and elderly women from the community are allowed to take the course of instruction.

The management of the school is by the principal and vice-principal, and the total number of instructors is 27. Of these, 15 are giving instruction in the trades and occupations taught. The number of trade students for the session of 1899–1900, the period for which the facts given in this report were gathered, were as follows: Dressmaking, 19; laundering, 12; baking, 4; cooking, 8; waiting on table, 8; shoemaking, 9; blacksmithing, 8; wheelwrighting, 1; printing, 8; cabinetmaking, 2; carpentry and joinery, 16; bricklaying and plastering, 6; farming and gardening, 14; sawmilling, 8; machinist's trade, 3; architectural and mechanical drawing, 16. The number of graduates is 116.

The cost of the buildings, most of which have been erected during the last seven years, was $45,000, that of their equipment $7,000, and the value of the property of the school is $75,000. The cost of maintaining the school in all its departments is $35,000 annually. The funds of the school are raised by appropriations by the Board of Missions of the Episcopal Church, voluntary contributions from friends in the North, and fees, etc., of the students.

The following information was gathered from officials of the institution: The courses could be improved if more means were at hand, and the outlook for improvement in the near future is good. While this institution is practically the only industrial establishment in its locality, and its influence therein is great, yet the practical benefits

resulting from the school are by no means confined to the community wherein it is located, but are far-reaching, as many of its graduates are from distant homes. Twenty States are represented by the students now in attendance, and there is also one student from Canada and one from Porto Rico. The school has greatly benefited the working people around it and has promoted their industrial, educational, and social development.

Those who have been in the school have been benefited in that they have been lifted from a slipshod method of work as a result of their instruction.

Employers generally prefer the graduates of the school as employees, because they have a technical as well as a practical knowledge of their trades and are thus better prepared to do good work than those whose only training was gained in the shop. Its graduates readily get work at their trades without undergoing a period of apprenticeship. As far as it has gone, the school has proved satisfactory and with more ample means will soon attain the end for which established.

INDUSTRIAL SCHOOLS IN THE SOUTH FOR WHITES.

SOUTHERN INDUSTRIAL COLLEGE, CAMPHILL, ALA.

Mindful of the need of an education which trains both the mind and the hand and cognizant of the fact that such a system had done and was doing much for the colored race in the South, the Rev. Lyman Ward, of New York, started a school of this kind for the white youth of slender means at Camphill, Ala. On September 21, 1898, he opened the school in an old house of but two rooms, with 23 pupils. The beginning of the third year (September, 1900) found a new building erected and occupied, 400 acres of land owned by the school, a faculty of 5 teachers, and nearly 100 pupils. The college as such was established on March 29, 1899.

In the first annual report it is said: "In the founding of this school it has been our purpose to do just two things: First, to provide a thorough course of study; and, second, to provide the means for pursuing it."

The teaching of three industries is provided for—farming, carpentry, and printing. Students taking the course in farming are required to work five hours on each school day and ten hours on Saturday. This pays in full for board and tuition.

In carpentry the student will begin with the coarser kind, learn all the various grades in the trade, and be graduated a finished carpenter. Learners in this department will be required to work five hours on school days and ten hours on Saturdays.

The school has a small printing plant and will give instruction to a few in the art of printing.

Tuition is $20 per year, and board from $5 to $8 per month, in which cost of room, lights, and fuel is included.

There have been no graduates as yet from this school, and a recent interview with one of its officials elicited the information that at present there were no instructors in carpentry or printing, but it was expected that those trades would soon be taken up and taught. The school has a sawmill which it expects to work soon and to instruct pupils in the occupation of sawmill hands.

ALABAMA GIRLS' INDUSTRIAL SCHOOL, MONTEVALLO, ALA.

This school, for white girls only, was established in 1896. The need which led to its establishment was that of furnishing poor white girls of the State industrial training at a cost within their means so as to make them self-supporting. Pupils between 14 and 21 years of age are admitted. Each county in the State is entitled to its quota of pupils according to the number of educable white girls in that county. The cost of the session for the entire course, which includes literary and industrial education (except music and art), is $94.55, payable as follows:

On entrance, September 19	$30.00
On November 15	25.00
On January 1	25.00
On February 15	14.55
Total	94.55

This amount includes the following charges:

Eight months' board, at $9.50 per month	$76.00
Thirty-three weeks' laundry, at 35 cents per week	11.55
Matriculation fee	5.00
Medical fee	2.00
Total	94.55

The course of industrial art is an extra, payable in advance at the rate of $2 per month. No pupil is admitted to classes until the payment required has been made, or is satisfactorily provided for.

The following industrial courses are taught: Cooking, dressmaking, millinery, and drawing and painting. In this last there are five courses, as follows: First, charcoal drawing from the cast and other objects; second, painting in oil, water color, or pastel from nature and still life; third, painting from life (the human figure) in oil, water color, or pastel; fourth, simple designing, which is divided into four elements—(1) lines and geometrical forms, (2) flower forms, (3) objects of use, (4) the animal and human form. These different heads are woven into patterns and working designs for use. Fifth, china painting. To secure a certificate in this department a pupil must have a good knowledge of drawing, learn the painting of china in all its branches and how to manage and fire the kiln.

The general management of the school is by the president and faculty.

The number of instructors in this school is 34, and 8 of these are employed in the teaching of industries or trades. Their training was had in college, trade and industrial school, and in work in the shop. The number of students during the last year was 421, and the total number of graduates from the institution is 178, of these, 92 having graduated from the industrial courses. The cost of the buildings and equipment, omitting the cost of one building donated by the people of Montevallo, which is not obtainable, was $125,000, and the cost of maintaining the school during the last year was $22,000. The income is derived from tuition and fees of the students and from appropriations made by the State legislature.

In the opinion of the officials the course could be improved by the use of more money in securing the best talent and equipment.

As girls come to the school from all over the State its benefits have been far-reaching. In the locality of the school itself there are no industries which can be affected by the school except dressmaking, and in this the standard of efficiency has been raised.

Those who have graduated have succeeded in getting good positions at good wages and are preferred by employers to those who have had no school training, for the reason that they have had not only thorough training at their trades, but have had academic instruction as well, which makes them more intelligent. No apprenticeship for graduates is necessary in this locality. The school has proved eminently satisfactory, but has not yet fully attained the end for which it was designed, as many industrial departments planned for have not yet been put in operation.

GEORGIA NORMAL AND INDUSTRIAL COLLEGE, MILLEDGEVILLE, GA.

This school was provided for by an act of the legislature of Georgia, approved November 8, 1889, and was opened on Monday, September 30, 1891. The need leading to the establishment of this institution, which is devoted to the education of young women, was the lack of opportunity for the obtaining of a professional and industrial training.

To be eligible to admission a girl must be at least 14 years of age, of good moral character, and of sound physical health. Students from a distance must board in the dormitory unless permitted by the president to do otherwise.

The fixed charges are as follows: Matriculation fee, $10; board, including fuel, lights, and laundry, $90; music lessons, instrumental, $27; music lessons, vocal, $27; music theory lessons, $9; painting and portraiture lessons, $31.50; drawing lessons, fine art, $22.50; cooking-school fee, general course, $2; domestic science, special course, fee

$5; sewing school, incidental fee, 50 cents; dressmaking school, incidental fee, $2; use of piano for practice, $4.50; model school, incidental fee, $2; diploma fee, $2; certificate fee, 50 cents; tuition fee, charged only to students from other States than Georgia, $40. In addition, an infirmary fee of 50 cents per week is charged students while actually occupying the infirmary. The general management is in the hands of the president of the college.

The purpose of the college is to prepare Georgia girls: (1) To do intelligent work as teachers; (2) to earn their own livelihood by the practice of some one or other of those industrial arts suitable for women to follow; (3) to earn their own livelihood as instructors in music or in fine art; (4) to exert an uplifting and refining influence on family and society by means of a cultured intellect, which can be obtained only by a systematic education in the higher branches of learning; (5) to be skillful and expert in those domestic arts that lie at the foundation of all successful housekeeping and homemaking.

To accomplish these several educational purposes, the courses of study pursued in the school are divided, in a general way, into five principal departments, namely, normal department, collegiate department, industrial department, domestic science department, and music and fine art department.

Several of these departments contain courses which teach occupations or trades, as follows:

Normal Department.—Course in normal and industrial art which includes the following branches: Free-hand drawing, color study, instrumental drawing, design, modeling in clay, historic ornament, study of artists and their works. These branches are closely correlated arts, and as taught in this college constitute a full two years' course of study. Industrial art, as understood and taught in the college, is that branch whose ultimate aim is to make practical designers and expert draftsmen, capable of making a working drawing of any article to be manufactured—from a broomstick to a palace—so that it may be placed in a workman's hand as a pattern. It includes free-hand and instrumental drawing of geometric views and patterns, and industrial designing, or the making of original patterns for wall paper, carpets, oilcloths, laces, dress goods, etc. In addition to the above course of normal and industrial art, the normal department includes a special normal art course based upon the course pursued in the Pratt Institute, of Brooklyn, N. Y. It not only qualifies pupils for positions as teachers of drawing, but also affords a splendid preparation for those intending to enter the field of industrial art.

Industrial Department.—This includes the business course, the course in sewing and dressmaking, and the course in industrial art. This last is the same course described above under the head of the normal department and is to be taken by students of both departments—the normal and the industrial. The business course teaches stenography, typewriting, and bookkeeping (each of which is outside the scope of this report). The sewing and dressmaking course teaches (1) domestic sewing, consisting of three grades of work, (a) simple sewing, including hand and machine sewing, darning and mending, and study of color, material, and cost, (b) advanced sewing, including cutting, fitting, and making undergarments, shirt waists, and unlined dresses, and (c) art needlework; (2) dressmaking, consisting of two grades of work, (a) first grade, including drafting of skirts and waists, exercises in fitting

and trimming, making of school uniforms, study of color materials, free-hand drawing and elementary design, and the use of patterns, (b) second grade, including drafting, cutting, fitting, and making of street suits, evening gowns, etc., free-hand drawing, water color and design, practice in designing dresses and dress trimmings.

Department of Domestic Science.—But two courses in this department can be considered as coming within the scope of this report. They are (1) the housekeepers' course, which is designed primarily to help young matrons and housekeepers who wish to make their household administration more systematic and efficient, but a secondary aim is the fitting of women to earn their livelihood as matrons or housekeepers in boarding schools and other institutions. It takes one year to complete, and includes teaching in cooking, household economics, marketing, home sanitation, sewing, and gardening and floriculture, the last two being optional. (2) The special domestic course, which is planned for those who desire to increase their earning capacity, but by reason of limitation in time or money can not take a more extended course. It covers three months and teaches cooking, household economics, marketing, home sanitation, and sewing and dressmaking, the latter two being optional. It gives a good working knowledge of cooking and sewing to those who have had previous experience.

The total number of teachers is 25, of whom 9 are teachers of the industrial arts. The different courses are so mixed and the industrial, collegiate, and normal training so overlap each other in the different courses taught that it is impossible to accurately show the number of pupils in each industrial course. Approximately, 200 are taking such courses. The total number of graduates who have had industrial training is 292, but no separation can be made so as to show the number attributable to each occupation taught.

The total cost of the buildings of the college was about $145,000, but the cost of the equipment of the same can not be given. The Mansion was formerly the mansion of the governor when Milledgeville was the capital of the State, and was built in 1838 at a cost of $60,000. The main building was erected in 1891, at a cost of $50,000; the annex was built in 1893, at a cost of $10,000, and Atkinson Hall was built in 1896, at a cost of $25,000.

The cost of maintaining —paying running expenses—is about $16,000 annually. The funds for building, equipping, maintaining, etc., are raised by State appropriations, contributions from the Peabody fund, fees, charges for board, tuition from pupils coming from beyond the State limits, etc. The income for the last year was: State appropriation, $22,900; Peabody fund, $2,000; fees, $4,600; tuitions, $3,000; total, $32,500. This does not include board paid in college dormitories, which was $22,500, and board paid in private families, which was $23,500.

While the industrial courses are excellent, in the opinion of the officials of the college they could be improved if more room and more teachers could be obtained. The cooking school is considered especially satisfactory.

It is stated that hundreds of the graduates have earned their own living in Georgia and other States by the practice of the trades and

industrial arts they have acquired in the institution, and that fully 90 per cent of the graduates have followed for a livelihood the occupations learned in the school. As a result of the school the general intelligence has been raised in the State, and industrial and social development has been promoted. This and other similar schools have been decidedly beneficial to those who have been under their instruction, and steadier employment and higher wages have undoubtedly resulted from the preparation for work received therein. Their graduates are preferred in industrial lines to shop-trained people, because they are more efficient, though ordinary shop training has not been improved by the example of the school. Graduates can obtain work at the occupations taught without undergoing a period of apprenticeship. On the whole, this and other schools of a similar kind have proved satisfactory and are fast attaining the end for which they were established.

LOUISIANA INDUSTRIAL INSTITUTE, RUSTON, LA.

The recognized need that young people should have a knowledge of such pursuits as will be useful to them and contribute toward their support led to the establishment of this institution. It was created by an act of the legislature of Louisiana in 1894, which located it at Ruston, Lincoln Parish, La., and placed it under the control of the governor of the State, two trustees appointed from the State at large, and one trustee appointed from each Congressional district of the State. By a subsequent act the State superintendent of public education was made an ex officio member of the board of trustees.

The original act provided that the school should be "for the education of the white children of Louisiana in the arts and sciences, at which such children may acquire a thorough academic and literary education, together with a knowledge of kindergarten instruction, telegraphy, stenography, and photography; of drawing, painting, designing, and engraving in their industrial applications; also, a knowledge of fancy, practical, and general needlework; also, a knowledge of bookkeeping and of agricultural and mechanical art, together with such other practical industries as from time to time may be suggested by experience, or such as will tend to promote the general object of said institute and college, to wit: Fitting and preparing such children, male and female, for the practical industries of the age."

The first session began in September, 1895. Its management is in the hands of the president and faculty and it is organized into the following departments: Language and literature; mathematics; history; civics; biology; physics and chemistry; mechanics (including drawing); business (including shorthand, bookkeeping, typewriting, etc.); domestic science; horticulture; dairying; elementary agriculture; music; printing, and telegraphy.

The work outlined provides for (1) a union of academic and industrial subjects, whereby educational and vocational training are combined, making acquisition and application inseparable; (2) the intensive study of the essential academic subjects, supplemented by the mastery of a vocational subject; the curriculum is designed to equip boys and girls for useful and noble living; (3) the daily use of shops, laboratories, and necessary facilities for good work.

To complete a course of study students must take all the announced academic subjects and one industrial. They will receive the degree of bachelor of industry upon the completion of a required course.

A certificate of proficiency is awarded each student upon the mastery of any industrial subject, provided that the student is found proficient in the accompanying academic studies. No student will be awarded a certificate of proficiency who is not versed in the use of good English.

Applicants for admission must be 14 years old and able to read, write, and spell with tolerable correctness. They must pass a satisfactory examination in arithmetic as far as denominate numbers.

The expenses per term of four and one-half months, there being two terms per school year, is about as follows: Tuition, to residents of State, free; tuition, students from other States, $25 per year; incidental fee, $5; boarding in the dormitory, $45; washing, $4.50; textbooks, $5.95; industrial text for shorthand, $1; music (per month), $3 to $5. Boarding students must furnish 4 sheets, 2 pillowcases, 4 blankets, 1 quilt, and 6 towels.

Instruction is given in the following industrial trades: Printing, mechanics (including carpentry and joinery, wood turning, pattern making, mechanical drawing, forging, making iron and steel tools, firing boiler and tending engine and steam pump), domestic science (including plain sewing, dressmaking, embroidery, and cooking).

The number of students taking the various courses during the year for which this report was made (1900–01) was: Bookkeeping, 58; telegraphy, 25; stenography, 40; printing, 25; mechanics, 50; domestic science, 60.

There are 13 members of the faculty, of whom 8 are teachers of the industrial occupations, several of whom have the degree of bachelor of industry from the Louisiana Industrial Institute, one is a master of science, one a graduate of the manual training school of the Washington University, and others have practical education.

The cost of the buildings was $43,500 and of the equipment, $50,000. The annual cost of maintaining the school is $30,000, which is raised by State appropriations.

With better equipment the courses at this school could be improved, although as it is they are excellent. The few industries in the locality of the school have been generally benefited, as has the general public

by the establishment of the institution. The general intelligence of the community has been raised and the industrial, educational, and social development promoted.

The intelligence of those attending the school has been increased, and they have obtained better positions and higher wages because of their better preparation for work, which makes them preferred by employers over merely shop-trained workmen. Work can be obtained by the graduates at all the trades taught without having to pass through a period of apprenticeship.

MISSISSIPPI INDUSTRIAL INSTITUTE AND COLLEGE, COLUMBUS, MISS.

The need of industrial education for white girls being recognized, the legislature of Mississippi, March 12, 1884, passed a bill establishing this institution, the first State college ever founded for women. Its purpose, as stated in section 2296 of the Annotated Code of Mississippi of 1892, is "The moral and intellectual advancement of the white girls of the State by the maintenance of a first-class institution for their education in the arts and sciences, and their training in normal-school methods and kindergarten, and their instruction in bookkeeping, photography, stenography, telegraphy, and typewriting, and in designing, drawing, engraving, and painting and their industrial application; and also in fancy, general, and practical needlework, and in such other industrial branches as experience from time to time shall suggest as necessary or proper to fit them for the practical affairs of life."

The general management and government is specially lodged in the hands of the president.

This school was opened for students in October, 1885. On the first day there were present more than 250 applicants. During the fifteen years since the opening (up to 1900) 2,600 young women have come under the instruction of the school, and of these 409 are still in school.

The State offers free tuition for 400 young women under the following provision of section 2303 of the Code of Mississippi of 1892: "Tuition shall be free for five years, and no longer, to girls of this State, in all branches excepting music." These girls are apportioned to the counties in proportion to the relation the number of white educable girls in each county bears to the whole number in the State. Girls from outside the State may be admitted if there is room for them, and the trustees are empowered to fix the amount of the tuition fee which they must pay.

Applicants for admission must be at least 15 years of age, in good health, and must furnish certificates of good moral character. Satisfactory entrance examinations must be passed, either at the college or before county superintendents of education. Those holding certificates from county superintendents are entitled to enter the business

course without further examination, but those desiring to enter other courses must take an examination at the college.

Students from other States can not be taken into the dormitories, but by paying a tuition fee of $30 per session they may be admitted into the college with the same advantages offered Mississippi students boarding outside the dormitories. Board to students in dormitories is furnished at actual cost, which averages, including furnished room, fuel, light, washing, etc., $9 per month.

Tuition in all literary and industrial studies for Mississippi students is free for the first five years they are in the institution; for students from other States, and for Mississippi students after five years, in literary and industrial studies, $15 per half session, to be paid in advance. A matriculation fee of $5, payable in advance, is charged all students. Charges for music lessons, payable in advance, are: Piano, per half session, $20; voice culture, per half session, $20; use of instrument for practice one hour a day, per half session, $4.

Each student must deposit for board at the beginning of the session at least $30, and must always keep the amount of one month's board to her credit. Students in analytical chemistry must pay for materials consumed and apparatus broken.

An infirmary fee of $5 per annum is charged to dormitory pupils. This covers medical attention by a skilled lady physician, trained nurse, medicines, except special prescriptions, which must be prepared at a drug store; physical culture, gymnasium exercise, and lectures on anatomy. Each student must furnish 1 pair of sheets, 1 pair of pillowcases, 1 pair of blankets, 1 bedspread, 6 towels, and 2 clothes bags.

Work in the college is of two kinds, required and voluntary. The occupants of rooms in the dormitories are required to do all the work necessary to keep them in good order. Work in the dining room, such as spreading the cloths, putting on the meals, placing the chairs, waiting on the table, etc., is required of the pupils, and for this regular details are made.

Students have the privilege of doing a part of the work in keeping some of the recitation rooms and furniture in order. They may sweep the halls, recitation rooms, chapel, music rooms, and do much of the light work in the laundry, and may also find employment in the dressmaking department. For this voluntary work they are paid, and for the amount they are allowed to do—not over two hours daily—they may earn $4 or $5 per month. In dressmaking they may earn more, being paid according to work done. Pay for voluntary work is:

Sweeping or laundry, per hour	$0.06
Postmistress, per month	3.00
Librarian, per month	5.00
Clerical work in offices, per month	$5.00 to 15.00
Additional work in offices, per hour	.10

Dress uniforms, the details being prescribed, must be worn.

The grounds cover about 25 acres, all in lawn and park, except 3 or 4 acres given up to the gardens.

There are four large buildings—the chapel, containing also class rooms, laboratories, offices, etc., the main dormitory, Columbus Hall, and the White House, which accommodates the departments of music and industrial arts.

These buildings have modern conveniences, are heated by steam and lighted by electricity. They are supplied with hot and cold water, also with fire escapes. The cost of the buildings and their equipment was about $175,000.

The cost of maintaining this school is about $60,000 per year, and the funds come principally from State appropriation, although a small amount is received from fees, tuition, etc. The city of Columbus gave the school $40,000 in land and buildings and $50,000 in cash for the sake of having it established within its limits.

The school offers three courses of study, viz: A business course for those who wish to prepare for industrial pursuits; a normal course for those desiring to teach in the public schools of the State; and a college course for those who aim at broad and thorough culture as the basis of future usefulness.

Whichever course is chosen, the pupil is required to pursue, in connection therewith, the study of some industrial art.

A certificate of proficiency is given to a pupil finishing an industrial art together with two years' work of the business course, and pupils in the industrial departments may withdraw at any time when evidence is furnished of having finished, to the satisfaction of the instructor, the course upon which they entered. A diploma is given to a pupil who has completed the entire business course. A diploma, with the title of Mistress of Pedagogics, is given to a pupil who has completed the normal course. A diploma, with the title of B. A., is given to a pupil who has completed the college course.

The department of industrial arts embraces bookkeeping, penmanship, stenography and typewriting, industrial and fine arts (design, modeling, drawing, wood carving, oil painting, etc.), dressmaking, and telegraphy. The course of study in industrial and decorative art and in dressmaking is as follows:

Free-hand drawing—with pencil and charcoal. Practice is given in drawing from solids, plants, casts, both with pencil and charcoal in outline, and also in light and shade. Much practice in free-hand perspective is given; also in enlargement from ornament; in conventionalization, and in composition in line, light and shade, and color. Mechanical drawing—including the construction of simple geometric forms; linear perspective (parallel, angular, and oblique). Historic ornament—analysis of historic style to borders, etc. Principles of design—illustrated by simple designs and also by more elaborate applied designs, such as surface patterns, borders, wall papers, oilcloths, prints, book covers, ornamented hinges, stained glass, etc. By earnest study this course may be completed in three years.

In the course in dressmaking the students spend the first few days in learning to work buttonholes, hemstitch, blind stitch, etc. From 15 to 20 pupils are engaged each hour during the school day learning first to draft patterns by measurement, and then to cut, fit, and make dresses. Most of the pupils learn in a short time to make their own dresses. To learn all that is required in this course takes from one to two years.

The course in telegraphy may be completed in one year. Pupils are required to take a course in typewriting along with stenography and telegraphy, and all learn to do neat and rapid work in one session.

There are 28 instructors and officers, of whom 5 are engaged in teaching the industrial occupations. They are all graduates of recognized institutions, and have practical experience as well.

The number of pupils in each of the courses of industrial art is as follows: Bookkeeping and penmanship, 45; drawing, leading to design, 132; drawing and design, 67; dressmaking, 190; stenography, telegraphy, and typewriting, 33.

The number of certificates of proficiency in the industrial arts issued up to and including the year 1899 was: Bookkeeping, 50; design, 4; drawing, 69; painting, 7; wood carving, 13; dressmaking, 124; stenography, 88; printing, 3; telegraphy, 19; and typewriting, 19; a total of 396. These certificates were given to 362 girls, several of whom received certificates of proficiency in more than one industry. One hundred and twenty-one girls have received diplomas from the business, normal, and collegiate courses.

Of the 362 girls above mentioned to whom certificates of proficiency were given, the present occupations of 290 are known, and are as follows: Teachers, 139; stenographers, 19; postmistress, 1; bookkeepers, 7; dressmakers, 4; cashier, 1; clerks, 2; telegrapher, 1; journalist, 1; students, 35; and residing at home, 80.

The industrial courses given here are considered excellent by the management, but they think there is need of others, such as millinery, photography, cooking, etc. The prospect of adding these courses in the immediate future is encouraging. It is stated that the industries in which women engage are few in the locality of the school, and its establishment has not benefited them much. The public schools have benefited greatly, because of the better teachers furnished, and opportunities are opening in industrial pursuits, and the schoolgirls are getting good positions as stenographers, bookkeepers, dressmakers, and teachers.

This and other similar schools make the students breadwinners and increase their literary knowledge. Higher wages, more rapid promotion, and steadier employment are found by reason of attendance at such schools, as they are better prepared for work.

The graduates are eagerly sought for by employers and receive the preference over shop-trained people, because they are not only more

accurate in their work, but also more intelligent. At all trades taught the graduates can work without passing an apprenticeship.

It is also stated that this school has proven satisfactory, and the State is giving it a more liberal support year by year. Its plans are copied by other States that are founding similar schools.

NORMAL AND COLLEGIATE INSTITUTE, ASHEVILLE, N. C.

This institution was opened in the fall of 1892 to meet the need for the training of teachers and Christian workers among the mountaineers of the South. The school is open to young white women only, and is under the control of the Woman's Board of Home Missions of the Presbyterian Church.

In its academic course it has a preparatory department and a normal department, and its other courses consist of a musical department, a commercial department, where stenography, typewriting, and bookkeeping are taught, and a department of domestic science, where sewing, including dressmaking and millinery, and scientific cooking are taught.

Every applicant for admission must bring a testimonial from her pastor or last instructor, and a certificate of health from a physician.

Only plain clothing is allowed to be worn and articles are specified. The charge for board and tuition is $50 per term or $100 per year, and for tuition without board, $12.50 per term and $25 per year. Bills must be paid in advance.

Aid to a limited extent has been provided for the needy and deserving student, which will be granted for the term.

The general management is in the president and faculty, 15 in number, who are graduates of colleges, normal schools, etc.

The occupations taught are: Sewing, dressmaking, millinery, and cooking. Instruction in these lines is given by 2 teachers.

All students on entering the normal department are required to take sewing, using the course taught at the Pratt Institute, Brooklyn, N. Y., and a great many have taken a partial course in dressmaking and millinery. Thirty-four have taken the full course of sewing, dressmaking, and millinery, and have received certificates. The total number of graduates from the school is 145. No further figures as to those taking the industrial courses, etc., have been obtained.

The cost of buildings, etc., is $86,000, and the annual expenses of maintaining the school is $15,000. The funds are raised by contributions from friends of higher education.

The following is a condensation of statements made by the management of the school:

The courses of instruction are good and could hardly be improved. As many of the Southern States have pupils in this school its influence

is widespread. Those who have attended the industrial department get better wages than they would without such education, have no trouble getting work, and receive rapid promotion. They are preferred by employers because of their better training. The school, on the whole, is satisfactory, and has fully attained the end for which established.

CHAPTER II.

ATTITUDE OF EMPLOYERS, GRADUATES OF TRADE AND TECHNICAL SCHOOLS, AND LABOR UNIONS IN THE UNITED STATES TOWARD TRADE AND TECHNICAL EDUCATION.

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This chapter presents in a condensed and summarized form the opinions of employing proprietors of establishments in a number of leading industries, graduates of trade and technical schools, and officers and members of labor unions in regard to trade and technical education. The information was obtained from representative persons in various parts of the country through personal visits by agents of this Department. The statements made set forth the opinions of the persons responding to the inquiries of the Department, just as the statements of the preceding chapter in regard to the schools are very largely the opinions of the school officials. All the persons personally interested in the subject thus speak for themselves. In no case should these criticisms or opinions be considered as emanating from this Department.

ATTITUDE OF EMPLOYERS.

BARBERING.

The general sentiment among employing barbers is that the schools for this trade, as now conducted, are of no value. This adverse sentiment, however, does not go so far as to declare that trade education is altogether unprofitable, as many employers believe that scientific preparation is a very important preliminary to practical training. One employer says that there is no doubt that the trade could be greatly elevated and improved by schools which would provide first-class scientific and practical training, and that a school properly organized would turn out better all-round barbers than can be done under the ordinary apprentice system, and with a considerable saving of time over apprenticeship.

BREWING.

The statements of manufacturing brewers are all favorable to the modern system of technical education as applied to the art of brewing. The knowledge and skill acquired by those who have attended brewers'

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schools are said to have resulted both in increasing the amount and in improving the quality of the product. The command of the market is regarded as due to the superior quality of the product, which in its turn is attributed largely to the superior knowledge and skill of those brewmasters and assistants who have had school training. Such men receive from 25 to 50 per cent higher remuneration than those holding corresponding positions who have not had similar instruction. Indeed, most manufacturers visited insist upon the brewmasters supplementing their practical experience with a course in school. Applicants for admission to the schools must have had actual experience in a brewery.

There is no regular system of apprenticeship in force, though several years of practical experience in the different departments is necessary before a workman is considered capable of taking up the work of a brewmaster.

The employees in breweries are generally well organized, the greatest numbers being found in the unions for brewers, maltsters, and coopers.

BUILDING TRADES.

The necessity of having a ready supply of first-class workmen is perhaps nowhere more important than in certain parts of this industry, and any system of instruction that has promise of increasing the general efficiency of the workmen usually meets with cordial support from the employers. The rate of wages is usually regulated by the labor unions, yet in some places the mechanics who have had the advantage of trade-school instruction receive higher remuneration and are also given steadier employment than those who lack such training.

There is considerable harmony of opinion regarding the need of more adequate facilities for training the workmen engaged in the various branches of the industry, but it is thought that little advance will be made unless the workmen themselves will take more interest in the subject. In the plumbing trade especially the employers experience great difficulty in inducing the workmen to attend the evening trade schools. In referring to this point, the head of one of the leading plumbing establishments in New York City says:

> The trades suffer most from the indifference of the workmen. When the average mechanic serves his time and becomes a full-fledged journeyman he thinks that his task is accomplished and he is satisfied to plod along in the beaten path trusting to luck to bring him something better. There always will be room for intelligent and well-trained mechanics, but we shall never have such a class until the men themselves realize that they must devote part of their time outside of working hours to studying the technical and scientific principles which enter into and must necessarily govern their operations in the trades more in the future than in the past.

Regarding the comparative merits of shop training and of trade-school or technical training, it is generally agreed that the trade school

alone can not make a first-class mechanic, as the usual period of instruction in such schools does not admit of sufficient practical work to enable the student to acquire that dexterity and tact which are essential. The best results are obtained when shop training is supplemented by such technical training as is given in the evening trade schools. This system it is said enables the student to apply the principles he is studying to the conditions and difficulties encountered in his daily work and he has a better appreciation of their value, and consequently takes more interest in his studies. The following statement by an employer of many years' experience is of interest on this point:

I have employed several hundred mechanics since I have been in business, and my experience shows that the men who have attended trade schools were in the end better mechanics than those who did not. The man who learns his trade in the ordinary way is a good mechanic up to a certain point. He can do good work and can follow instructions and map out a simple job. But when it comes to the more difficult tasks and to the work of supervision, he is not the equal of the man who has supplemented his trade work with a course in a trade school. The young man who learns his trade in the ordinary way merely follows the journeyman with whom he is working, and learns just what the journeyman sees fit to let him learn, and no more. In some trades he is advanced or held back at the will of the journeyman, and unless the latter is personally interested in his success or has a special liking for him it is seldom that he is told why the work is done thus and so; the technical points are not explained to him, and consequently he is left to pick up the trade as best he can. On the other hand, the young man who goes to the trade school is afforded every opportunity to learn all parts of his trade. The instructors are men who have had years of experience in practical work, and they are paid to give him the benefit of that experience. He is instructed how to do his work according to the most modern methods, and is told why it is best or necessary to perform his task in a particular manner. He obtains a knowledge of architectural drawings which is helpful in his trade, and he must attend lectures on the subject he is engaged upon, and the scientific principles, building regulations, and sanitary laws which govern his trade are fully explained. These are advantages which the average mechanic does not enjoy when learning his trade in the ordinary way, and it is the possession of them that makes the student workman more valuable to his employer and enables him to mount higher in the industrial scale.

A formal stage of apprenticeship is usually required, and in most places the number of apprentices in each trade is limited to conform to the requirements of labor unions. In some cases it is thought that the period of apprenticeship is unduly prolonged by the labor unions. In almost every instance the employers agree that the prevailing system of apprenticeship does not provide the apprentice with full and adequate instruction. In some branches the tendency to specialize has brought about a subdivision of labor, which makes it impossible

for the apprentice of the present day to learn every part of his trade as he could years ago. The sentiments of the master builders and plumbers on this point may be summarized as follows: No man can learn all the requirements of the trades as practiced at the present day unless he devotes more or less of his time to studying the scientific principles and sanitary laws pertaining to the same. The building trades have been greatly benefited and elevated through the efforts of architects and sanitary engineers, but the employers in the industry have met with much difficulty in their efforts to make a corresponding advance in the methods of execution.

All trades in this industry are represented by labor unions.

BUTTER AND CHEESE MAKING.

Perhaps no other class of schools has ever been more popular than the dairy schools in the agricultural sections of the country. It is said that they have practically made the creamery industry what it now is. The industry would naturally have grown to great proportions in time, but the schools have done in a decade what would otherwise have been accomplished only in many years. The number of creameries has increased at a rapid rate, but the quality of butter produced has been improved and made more uniform, and in most cases the cost of production has also been lessened.

All this has tended to drive "cottage" creameries out of existence, and they are now quite rare. The more prosperous ones have grown into factories, while others have been abandoned because the owners found it more profitable to sell their milk to the larger establishments. That this results largely from the influence of the schools is indicated by the following remark made by the secretary of a dairy company in Minnesota: "We would not operate a creamery if we could not get a man who had been trained in a dairy school." The preference for school-trained men is very marked, and they receive from 20 to 50 per cent more wages than those who have not attended a school. The best butter makers are, of course, those who have had both school and factory training.

While the industry is now quite a large one, it has not nearly reached its possibilities. More schools, longer courses, and still better practical training would both enlarge and improve the industry. It is the opinion of some that without this extension and enlargement of facilities for training further progress will be slow.

School men must serve an apprenticeship of one year, and this is regarded as desirable before attendance upon the school. For those who do not attend school an additional year or two of apprenticeship is required.

There are no labor unions in the dairy trade.

CAR BUILDING.

In this industry design and workmanship are of about equal importance. The shop-trained man is said to be the more skillful mechanic, while the man with technical training naturally makes the better designer. Consequently, to get the best results both kinds of training are essential. The business could be enlarged and improved by a more ample provision for trade instruction, as even the ordinary mechanic could profitably take a course in technical training.

Labor unions, which are found in all branches of this industry, place some difficulties in the way of car builders' apprentices by prolonging the term of apprenticeship which is required in all the principal occupations.

Shop instruction in this industry is not systematized, but is given in the ordinary course of the work.

CARRIAGE BUILDING.

Among manufacturers in this industry there is found to be quite a diversity of opinion as to the value of trade schools.

The head of a large establishment in Illinois states that trade or technical schools have thus far been of no particular benefit, for the reason that the graduates of such schools lack both originality in design and a practical knowledge of the details of construction. But in New York and other places in the East it is held that the school for carriage draftsmen in New York City has rendered valuable service to the industry at large by affording special training for superintendents, foremen, mechanics, and others who are engaged in various branches of the trade. The National Association of Carriage Builders contributes liberally toward the support of the school.

It is said that the command of the carriage market depends, first, upon the quality of work, and, secondly, upon design; consequently it is of the highest importance to have first-class mechanics. In most establishments the policy is to employ finished workmen in all departments and to have as few apprentices as possible. The reason for this is that most apprentices are averse to serving the full term. They are satisfied to stay in a first-class shop until they have partially learned the trade and then go away to cheap shops where they work by the piece and earn higher wages for the time being, but they never become finished workmen. Those who serve a full period of apprenticeship in a first-class establishment receive thorough instruction in all parts of the trade. The president of one establishment favors the old apprenticeship system of New England by which seven years' service was required. He says the abandonment of that system has led to a scarcity of good American workmen, and the consequence is that our finished workmen come largely from abroad.

CHEMICAL INDUSTRY.

The following statement is furnished by the proprietor of a chemical manufacturing establishment in one of the Middle States:

We have four men in our employ who have completed a course of instruction in a technical school, and they fill important positions in different departments of our works. The special training that these men received in school has made them more valuable and better fitted for the business. The industry would undoubtedly derive some benefit if further provision were made for trade or technical schools which would afford the foremen and workmen more adequate and modern facilities for studying the theory and science of the trades. Industrial art museums showing the progress made in the different branches would also be an advantage. Generally speaking, shop training is mechanical, similar to a machine applying or doing a certain thing and requiring little use of the thinking or reasoning faculties. The average shop-trained workman learns to do a thing in a certain way and has little concern whether it is the best way or not, so long as it answers his purpose. On the other hand, the moment technical training is taken up the interest is aroused, the thinking powers are called into action, and the student or workman asks himself why he is doing or applying this or that thing and what the effect will be. The mechanic gets interested in the metals he works. Becoming familiar with their composition, the coppersmith gets to know what the scales are that peel off the copper when heated, and he learns why tin cracks when he bends it; the plumber makes traps and air vents in his work, and the technical school teaches him why they are used; the mason learns the properties of lime and cement and the effect produced by mixing them with water, etc.

In other words, trade-school and technical training induces the mechanic to think. It teaches him why it is necessary to perform his work in a particular manner and unfolds the scientific principles applicable to his trade, the knowledge of which enables him to become a master artisan.

CLOTHING INDUSTRY.

The instruction in the art of garment cutting given in a prominent school in New York City is highly commended by clothing manufacturers and merchant tailors in all sections of the country. Both branches of the industry have been greatly benefited by the work of this school, the technical training afforded the graduates resulting in many noticeable improvements in the general character of the product. In this industry the command of the market is largely a matter of superior workmanship, and in the merchant-tailoring branch especially the skill of the cutter, who, in most cases, does the fitting also, is of paramount importance. Many of the best cutters learned the trade under shop instruction only, but those who have supplemented their trade work with a technical course in a recognized school receive higher wages and are considered more desirable by employers. An apprenticeship of three years is usually required in cutting, which

period is reduced to one year in favor of journeymen tailors. But in the tailoring branch there is no fixed period. It is said that good instruction can be had in some first-class establishments, but thorough instruction in all parts can be obtained only in exceptional cases. In some of the Southern and Western States tailors' schools are regarded very favorably on the ground that they not only relieve the employers from the annoyance and loss incident to teaching "green hands," but they give general instruction in all parts of the trade and thus make it possible for the student to obtain a more thorough preparation than can be acquired in the average shop.

The garment cutters and tailors are largely represented by labor unions.

DOMESTIC SERVICE.

Persons reporting under this head are of the opinion that girls who have graduated at training schools for domestics do better work and more of it in a given time than those who have not had such training, and they do not require constant oversight. They get no higher wages, as a rule, because all domestics, whether competent or not, demand about the same pay.

Were more women (housewives) proficient in housekeeping themselves, and had they the time, inclination, strength, and patience to do so, they might produce as good servants as the training school. But under present conditions this is seldom the case, and the opinion is expressed that there must be an extension of the system of school training if there is to be an adequate supply of properly trained servants.

DRESSMAKING.

The proprietors of dressmaking establishments in which graduates of dressmaking schools are employed state that the work of this class of help has been uniformly satisfactory and in several instances has tended to improve the character of the product. For ordinary work the average shop-trained sewer or maker is equal to the school-trained help, and is in many cases even better; but in the art of cutting and fitting the graduates of the schools are said to be far superior. In fact, there are very few shop-trained employees engaged as cutters or fitters, this work being usually performed either by the head of the establishment or by a graduate of some school.

It is the unanimous opinion that shop training alone does not provide the apprentice with full and adequate instruction in the trade, the reason assigned for this being that while sewing and making are in many cases taught much better in a dressmaking establishment, yet, because of certain business considerations—chief among which is the unwillingness to instruct one who might become a competitor in the same line—the proprietor is seldom willing to teach the art of

cutting and fitting. There is no regular period of apprenticeship. Some girls become proficient in six months, and some require two years. The business constantly suffers for lack of competent help, and it is thought that more good schools would be a benefit to the trade generally.

ELECTRICAL APPARATUS AND SUPPLIES.

The returns for this industry show that most of the leading establishments employ a large number of graduates from the higher technical and scientific schools. A number also report having graduates of trade and secondary technical schools, and several state that many of their employees are taking courses in correspondence schools, and in the mechanical classes conducted by the Young Men's Christian Associations and other night schools. It is stated, without exception, that the work performed by school-trained workmen has proved satisfactory in every respect. All agree that further provision of trade and technical schools would be a benefit to the industry and those engaged in it. In referring to this point, the treasurer of a large establishment in Chicago, Ill., says: "A comparatively small number of thoroughly trained mechanics seek work in our shops, and as the wages are high enough to be attractive it can only mean that there are not enough trade schools to supply the demand. All lines of manufacturing would surely be benefited by a larger number of employees from trade or technical schools." It is the general opinion that practical experience or shop training is necessary, but that the best results are reached only when this is supplemented by trade-school or technical instruction. One employer, who is a strong advocate of school training, says: "In all departments where high-class work is done we pay good wages and are always anxious to get technical men. They are broader minded and have a wider mental grasp than the man who left school at the age of 16 to learn his trade in a shop. In technical or any other kind of work the young man who has been trained in a technical school very soon overtakes and outstrips the man who has practical experience only. Their remuneration at first is no greater than that of the others who do similar work, but in almost all cases it increases more rapidly and there is practically no limit to their promotion, while the man without technical education, unless in exceptional cases, finds his field of operations greatly restricted."

FURNITURE AND CABINETMAKING.

In this industry design and workmanship are of about equal importance. The manufacturers furnishing information state that the only school-trained men they have are employed either as foremen or designers, and that in both positions technical training is indispensable. The

opinion generally expressed is that a further provision of trade and technical schools would be beneficial. New and popular styles of furniture would be multiplied, and this would no doubt increase the sales of high-class goods. While it would not necessarily enlarge the business, it would tend to elevate it and make it more profitable. One manufacturer states that failure to provide more and better facilities for trade education might have a bad effect upon the industry, were it not for the fact that our manufacturers can draw upon the schools of Europe for skilled workmen, and that there is no difficulty in procuring this class of help from abroad because of the higher wages paid in this country.

The man who wants to be a master of his trade must have both school and shop training. School training enables him to rise higher in the scale of proficiency and to do it more rapidly, but he must have experience. A designer can not know too much about shop methods, and the mere mechanic is better equipped by having technical knowledge.

Some establishments require a formal stage of apprenticeship, and others do not, the latter preferring full-fledged workmen only. Such instruction as is given in the shop is not systematic. The term of apprenticeship is elastic, so as to meet the necessities of each individual case. Under this plan the bright apprentice forges ahead and becomes a journeyman sooner than the boy who is ill adapted and careless.

HARNESS MAKING AND REPAIRING.

In this business good workmanship and good material are the main factors in commanding trade. The proprietor in an establishment in one of the Southern States says that he has one young man in his employ who has graduated from a trade school, and his services have been very satisfactory. The work of this graduate has helped to improve the character and quality as well as to increase largely the amount of his product. So far as this industry is concerned, he believes that trade-school training is superior to shop training, for the reason that the latter is neither systematic nor comprehensive. On the other hand, the instruction given in the trade school is designed to give a thorough knowledge and training in each part. A formal stage of apprenticeship is required of beginners, but in the case of trade-school graduates no apprenticeship is necessary, as they must be competent to engage in practical work before graduation.

JEWELRY.

Generally speaking, the work of engravers, chasers, and designers who have had the benefit of instruction in trade or technical schools or schools of design has given much satisfaction to employers. A manufacturer located in one of the Western States says: "Since

employing graduates of a school of engraving our production has increased, and we have been able to turn out 25 per cent more work than we did with a similar number of shop-trained workmen. The character and quality of the work is better and we pay them from 10 to 25 per cent more wages than the others." In one of the Eastern establishments the school-trained workmen receive from 25 to 50 per cent higher wages than those who have had shop training only.

It is said that whatever tends to higher education along trade lines must improve the taste and skill of the workmen, and therefore a further provision of trade or technical schools, or schools of design, would be a benefit to the industry. With one exception it is the opinion that school-trained workmen are more capable and produce the best results. There are some things which can be learned only by experience in the shop, but the school-trained man is a thinking workman and will absorb more from experience and learn more quickly than one who has not had such training. The exception noted above is in the case of a prominent Eastern concern, the superintendent of which is of the opinion that shop training is best. This establishment has a systematic course of instruction for apprentices, and in addition to the regular shop work there is a library of reference and design, with nearly 3,000 volumes, and hundreds of models, casts, and electrotypes, to which all have free access. This affords unusual opportunity to the apprentices to acquire a knowledge of the theoretical and artistic requirements of the trade, and under the careful guidance of the heads of the different departments, whose duty it is to give every possible aid, they are able to obtain thorough instruction. Only one other establishment reports taking apprentices.

METAL TRADES.

Of the 80 establishments in this industry from which schedules were obtained, 8 report that the special training of their workmen in trade or technical schools has resulted in increasing the amount of the product from 10 to 20 per cent, and in one case 50 per cent; 25 report improvement in the character and quality of the product, and 20 report that workmen who have had the benefit of instruction in these schools receive from 10 to 50 per cent higher wages than those who have had shop training only. One of the most notable illustrations of the practical benefits which result from the education afforded by trade and technical schools is found in the case of a large manufacturing establishment in Massachusetts. The superintendent of this establishment has furnished the following statement:

Recognizing the advantage of trade and technical education, a few years ago we adopted the policy of allowing our employees, without loss of wages, the privilege of attending an afternoon class which we had succeeded in having established for them in a local trade school.

The knowledge acquired by these men, together with the training received by many others in our employ who attended the night classes in the school, has been of inestimable benefit to our business. The workmen are more intelligent and better qualified to advance in the trade, and they require far less oversight in the performance of their work. The presence of these trained workmen distributed through our shops has had a beneficial effect upon those with whom they come in daily contact. They have stimulated the desire for technical instruction among those who otherwise would have neglected it, and they have been a powerful factor in elevating the general character of our product.

The technical education of these men, added to their previous training in the shop, has made it possible for the company, by their aid, to promote all departments of its manufacture, and, among other things, to enter quickly and successfully upon and establish the manufacture of an entirely new line of machinery. This has resulted in increasing our business fully 50 per cent; the positions and wages of our workmen have been correspondingly improved and advanced; work has been provided for many additional workmen, and the investment in our plant has been increased. At the time when this special work was undertaken the other trained men in our employ were busy with other things. To have organized and utilized with equal rapidity and success a sufficiently large force of skillful strangers would have been an undertaking attended with grave difficulties, if not an impracticable one. Prior to the invention of this line of machinery, except to a trivial extent, the American market was controlled and supplied by foreign manufacturers. Therefore, it is not too much to say that the special education of our workmen has materially contributed to the establishment of a new industry, of no small proportions, which did not before exist in the United States.

In the majority of cases superior design coupled with good workmanship is deemed essential to command the market, though a number rely upon superior workmanship only. Of those who express an opinion regarding the need or advisability of making further provision for trade or technical schools, a few seem to feel that the present schools afford ample opportunity for those who have any desire to attend them. This feeling is quite common in places where the workmen are disposed to overlook the importance or necessity of attending the evening classes in local trade or technical schools. Other manufacturers are of the opinion that every industrial community ought to have evening trade and technical schools, and that all apprentices should be compelled to attend them. In places where schools are not convenient many of the apprentices and workmen have taken up the correspondence courses of instruction, and several large concerns report very satisfactory results from this method. The president of an establishment in Pennsylvania which gives employment to more than 7,000 workmen states that instruction by the international correspondence system has in many cases fitted the workmen for higher positions than they would otherwise be qualified for in the natural course of their

work. An establishment in Ohio has some forty workmen who are studying mechanical drawing by the correspondence method, and to encourage them in their studies the company provides a room, with drawing boards and instruments to do their work. It is the policy of this company to limit promotion in the drafting room to this class of workmen.

As to the comparative merits of shop training and of trade-school or technical training in the different branches of the work, some are of the opinion that for ordinary work in the construction departments shop training alone is sufficient. It is said that school training offers no particular advantages in such work as it is mostly done by machinery, and the tendency is to construct machines which will act automatically and require but little skill on the part of the operator. In the pattern-making department and in the important operations in the machine shop, especially in the construction of fine and complex machinery, an exact knowledge of mechanical drawing is deemed essential, and in some cases it is said that those who are engaged upon such work ought also to have a knowledge of mathematics, physics, and machine design. In the drafting and designing department it is generally conceded that the workmen who have had the benefit of a course in a technical school are in the end superior to those who have learned the trade in a drafting room alone. It is said that the average draftsman aims to become a designer, but before he can attain that end he must be able to understand the principles involved in his work and to think with scientific precision. The cost of construction and the commercial value of a machine must be taken into consideration when it is being designed, and the man whose technical training has been supplemented by practical experience in the shop is better fitted to handle those things than one who has had only a shop training. A few manufacturers state that they prefer shop-trained workmen in all departments, as they consider them more practical. Generally speaking, however, the manufacturers, superintendents, and foremen engaged in the various branches of the industry agree that the best results are obtained when the workmen have had school training and shop training also. A number of manufacturers comment upon the limited time usually devoted to shop work in the schools, and state that to be effective the time should be extended and the practical work made more comprehensive. By having longer and more varied practical work in the school, the graduate would meet with less difficulty in adapting himself to the details of actual work, and he would consequently make better progress.

The workmen who have acquired a trade or technical education might properly be divided into four classes, as follows: First, those who have attended a trade or technical school before entering upon practical work in the industry; second, those who pursued their school training in the evening at the same time that they were serving their

apprenticeship in the trade; third, full-fledged mechanics, who, having learned the practical part of their trade, attended the evening schools to obtain a technical and scientific knowledge which would enable them to make better progress and advance to positions of responsibility; and fourth, those who secured the technical portion of their training by a correspondence course of instruction. The opinions of the manufacturers regarding the qualifications of these men, and the methods of instruction, may be summarized as follows: The young men who enter the workshop fresh from a trade or technical school are not practical. As a rule they have had just enough shopwork to make them think that they are practical, when in fact they are not. Some of them have exalted ideas of their ability and, if left to themselves, will waste material and, therefore, are expensive to their employers. But, after they have been in the shop a few years and are drilled in shop methods, they make the best class of mechanics and can be trusted with the most difficult and important kinds of work. Workmen who have had a good technical education make the best men to fill positions as foremen or superintendents. The best results are achieved in the least possible time by the men who have worked three or four years in the trade before going to evening technical schools, and by the apprentice who attends school while serving his apprenticeship. Of these two plans the latter is considered preferable. It permits the theoretical and practical training to be carried on simultaneously and is more interesting to the student workman. Moreover, it enables him better to appreciate what he is learning, and he develops much faster and is more valuable both to himself and his employer.

A formal stage of apprenticeship is required in all important occupations, and in several places the number of apprentices is limited to conform to the requirements of labor unions. The majority of those who express any opinion upon the subject think that the shop training of apprentices is not unduly prolonged or made needlessly difficult by the labor unions.

The consensus of opinion regarding the efficiency of the so-called apprentice system seems to be that it does not afford full and adequate instruction in some of the trades which are found in this industry. This is particularly the case in large establishments. The facilities for learning the practical side of drafting, pattern making, and molding are said to be as good as ever, but in the machine shop the tendency toward specialization has become so pronounced that very few apprentices learn the entire trade. The custom seems to be to shift the apprentice about until he shows special aptitude at some particular part, at which he is held, as his proficiency in that part makes his services more valuable to the employer. In this way the apprentice learns an occupation, but his energies and talents being devoted to the production of one or two parts he becomes a specialist only. While

some manufacturers seem to be well satisfied with the system of specialization which has come into general use, there are many who feel that it is not entirely satisfactory. Among the latter class are represented two of the oldest and largest industrial establishments in the country which have organized systems of apprenticeship that are said to be productive of great benefit both to the workmen and their employers. One of these establishments, the Baldwin Locomotive Works, employing nearly 11,000 workmen, has recently made a complete change in its apprentice system, departing entirely from the specialist idea and reviving the old indenture system, with such new features as experience has shown to be advisable. The following statement by Mr. Samuel M. Vauclain, superintendent of this establishment, made before the Engineers' Club of Philadelphia, and published in the proceedings of the Engineers' Club for January, 1902, sets forth so clearly and forcibly the reasons for the adoption of this system on the part of this great company and the methods pursued with the apprentices that it is worth quoting here at length:

In handling several thousand apprentice boys it became apparent to me that no matter how well the apprentice was taught in the workshops, or how much he was encouraged to go to the various night schools in our city, such as the Franklin or Spring Garden Institute, the Young Men's Christian Association, Drexel, or others for the technical part of his education, we found that he desired something to show that he had learned the art or that he had served a specific time at this art. In other words, he was just as anxious to get his diploma as the young man who graduates from the university, or from Sibley or Stevens, or some such institution, and in my opinion was just as much entitled to it. It became apparent to me also that if we were to remain successful in competition with the world we would have to get to work at once and systematically educate our apprentices, not only in so far as the handicraft is concerned, but that they should have a certain amount of technical knowledge to go with it, and that that technical knowledge should go hand in hand with the manual training that they were receiving in the shops. Very naturally the thought occurred to me, "What are we going to do with the great unwashed—the boys who can not go to school—the boys who are turned out of the grammar schools, perhaps, before they have barely entered them?" The parents must put those boys to work, and, fortunately for us, the laws of Pennsylvania relieve us of this mass of humanity—poorly trained, poorly educated, and with the greed of gain, the only thought their parents have in placing them at work. The law forbids the employment of any boy under 16 years of age, and over 13, only when his parents go before a magistrate and get a permit; consequently we are able to keep out of our workshops all boys under 16, except those who are the sons of widows and who must have employment somewhere. Those boys we employ as messengers, and keep them and train them and bring them along until such time as we can put them to a trade. Our idea in establishing three grades of apprentices was to take care of the three grades of boys that come to us. First, the boys of the masses—the boys of ordinary education—very ordinary

education indeed; these boys we compel to remain with us four years. We require that they shall go outside at night to some of the many night schools and take a one-year's course in elementary geometry and algebra in order to get a slight knowledge of them. The second and third years they must attend drawing school. They must take a two-year's course in drawing outside of the workshops. At the expiration of the four years we give these boys a bonus and we discharge them from our employ. They get a diploma—their indenture is their diploma; their bonus is their reward and the wherewith to go elsewhere and seek employment. Now the high school boy is a well educated boy. I defy any young man of eighteen to go before an employer with a better education than those boys who come to us from our Philadelphia high school. He has a good knowledge of geometry and many of the higher branches of mathematics; he knows something of mechanical drawing—enough to go on with the work; therefore, we omit with this boy the preliminary course in elementary algebra and geometry, and we prescribe that for two years he must attend night school in mechanical drawing in order to perfect himself, in order to learn to express his thoughts upon paper as he absorbs ideas in the workshop. We also give this young man a bonus, and we only require three years of service from him on account of the superior education he has when he comes to us. The superior education enables us to grasp more quickly the needs—the place to put him—and he more or less readily absorbs the instructions given him from his immediate superiors through the superintendent of the shop. The bonus this young man gets is $100 in place of the $125 of his more unskilled companion. This $100 we think is sufficient to enable him to go elsewhere and secure employment, and we are never ashamed to let one of those apprentices go for that. He always shows up well. The third man to take care of is the graduate of our universities—the ordinary mechanical engineer who comes to us not quite so green as grass so far as mechanical handicraft is concerned. He is willing to get down to the hardest work we have in our shop, and he works at it like a steam engine. He has all the technical knowledge that is necessary. He has it, but he does not know how to use it. We encourage him in this manner: We can not indenture him, being a man, but we make a specific contract with him for two years and pay him enough to keep body and soul together. We give him 13 cents an hour for the first year, and 16 cents an hour for the second year, and a clean certificate at the end of that time. We have not had a man of that description for that length of time who has not been lifted out of the position he had contracted for and is enjoying a much more remunerative position and in the line of promotion. Now, it is from these men that we must fill the superior offices in our workshop, and these boys we promote. The man or boy who has determined to get to the top, and will burn his candle at night to gain the knowledge that his more favored companion has received in a better institution of learning than he has attended, also gains his reward. The third boy we must have to fill the ordinary ranks in the workshops, and the better educated we can have the ordinary rank and file in our workshops, the better chance we will have of competing with our foreign manufacturers, the better chance we will have of extending the markets of American manufactures throughout the world, and it is only by this that we can do so. You have asked me

why we can afford to do this—why we can afford to turn away from the doors every year several hundred young men. We do not expect to keep them all. We will keep the better ones that we come across from time to time. We promote them, so that their ambition will permit them to stay with us. Have you not already seen the point? Every one of these men that go forth from an establishment of this kind will sing its praises forever. They will shout just as lustily for the Baldwin Locomotive Works as they have done for Yale, Harvard, or the university, or any other institution they have left. You will have an advertising medium that can not be surpassed by anything, and, further than that, you will have established in your own workshop a set of men that will be invaluable—that you can never hire in the open market. When I hear a manager say he has had so many men call in his efforts to secure a foreman, he has tried and tried to get certain men to do certain work and failed, I pity that man. That man has not the courage to go down in his pocket and labor for a few years to train men to fill these positions, and if you can put out your coin—if you have the small courage to hand it over to these young men—you will get it back tenfold before you know where you are.

The Baldwin Locomotive Works do not intend to give night instruction. They do intend to impart the technical knowledge. We depend upon the various night schools established throughout the city, and we pray for the establishment of more and better night schools to give instruction for that portion of the training of the apprentices. The manufacturer has the commercial side of the question to deal with. He can impart the commercial side of the business in connection with the technical training. He must be a manual student commercially. He must be able to make that work pay. He must be able to get it out for a certain sum of money, and he must be able to get it out well for that money, because the better his product is the more work will come into that workshop; and, therefore, if the foremen, or the superintendent, or the owners, or the managers of these manufacturing institutions will give their time and attention to the handicraft—the manual training—they certainly should expect to get the technical portion for the work of their students outside. Now, in order to make a scheme of this sort successful, one must make a business of it. You can not hand these boys over to the tender mercies of a foreman, because it is not one out of fifty who can take a boy and who can say to himself, "That boy is perfect on that work; here, give him another planer; there is no use keeping that boy on that work any longer." No, he will keep him there until the superintendent says, "You must not keep that boy there any longer; you are doing him an injustice." In order to avoid such a condition of affairs, I felt that we should have a superintendent of apprentices, a man whose business was to look after the apprentices, not only in the shop but out of the shop—a man who would see that he is taken care of, and see that the foreman does not take advantage; but as fast as the boy learns he must be pushed along. We hire him for what he learns from us for the future, and we must have that boy pushed along so that he can learn, so that he can absorb everything that is capable of being absorbed in that shop. If he is not capable of being pushed along so fast, he is pushed along slowly and more care is taken of him. We do not want to allow that boy to sink down

into disappointed youth. We just want him when he is 21 to be able to work and to go on and keep on working with irresistible energy. Now, this superintendent of apprentices must do that work, and he must further see that the boy carries out his side of the contract—that he attends these night schools. He must see where he goes; he must examine into the matter; he must see the boy's teacher or professor, and he must report upon that boy's progress, so that we can form a determination of the value of this apprentice from a technical standpoint. We find it very difficult to provide for a certain branch of this work, but great effort is being made to carry it on for any number of boys. The public schools are taking an interest; everybody will take an interest in it after a while, when it becomes known. It is the right policy, if we can only interest manufacturers to establish a system of this kind. All those interested will find all they can do to keep up with the other end of the business if the manufacturer will take care of the handicraft; and until that time does come, if we can not obtain the technical education for these young men outside at night, as we should, the only thing to do is to establish an educational institution of our own and take these boys so many hours from work and say you must go there and receive it. Insist upon it. It does not cost much. You can get a good educator for $3,000 a year, and what is $3,000 when you divide it up among a thousand boys? Three dollars for each boy. And if those boys are worth anything they will not only earn their wages, but they will earn a great deal more. They will earn the money you might spend upon their education, and in the years to come they will be grateful for the trouble you have taken to make better men of them.

The other establishment referred to is the well-known Brown & Sharpe Manufacturing Company of Providence, R. I. Though this company has always maintained an excellent system of apprenticeship, the system now in force has existed only since 1897. In speaking of the system, the superintendent says:

In an establishment of this kind, engaged as it is in the manufacture of machine tools of the utmost accuracy and fineness, men of the highest degree of skill and proficiency are needed in all departments. The superintendents, foremen, and higher class of mechanics must not only have a thorough practical training in the shop, but in order to understand and overcome the many intricate problems which constantly arise in connection with their work, they must also possess a certain amount of theoretical and technical knowledge which can not be acquired in the shop.

The tendency of the times in manufacturing is such that all machinists and mechanics who are trained in the shops only, in the ordinary course of business, become specialists and never attain a thorough, all-round knowledge of their trade. If a man or boy in a machine shop does particularly good work with any one machine or at any one operation the employer can not afford, under the severe competition now existing in the industries, to shift him from said machine or operation and give him work of another kind simply for the purpose of teaching him the whole trade and having him become skilled in all of its processes. The consequence is that as a rule the workman passes his working life performing one operation only and never acquires a

complete knowledge of his trade. Even if this condition did not exist, and it were possible so to shift a workman about that he could learn all the operations carried on in the industry, it would be a wasteful method, and when all had been learned that could be in this manner it would be mostly knowledge of a practical kind only, and the technical and scientific knowledge necessary to make the thorough craftsman would still be wanting. This knowledge can be supplied only by some form of school training.

The all-round, thoroughly trained mechanic is needed in moderate numbers, and the best way to supply this need is to begin with the apprentice and put him through a systematic, theoretical, and practical course of instruction, and this is the plan upon which our system of apprenticeship is conducted.

The apprentices are under the immediate charge of a superintendent of apprentices, whose sole duty it is to look after them and arrange and superintend their instruction. The shop instruction covers a period of four years and embraces six months' work on the lathe, six months' work on the milling machine, four months' work on the planer, six weeks' work on the drill press, three weeks' work in scraping, six months' work in assembling parts, six months' work in erecting machines, and the balance of the term is spent in the drafting rooms and in general shop practice at operations not specified above. This brings the apprentices under the instruction, at one time or another, of every foreman in the establishment and enables them to acquire a thorough knowledge of every detail. During the entire period of apprenticeship one hour every two weeks is devoted to a lecture or a discussion upon some subject bearing upon the trade, and to assist the apprentices in their studies the company maintains a circulating library of technical works.

In addition to the regular shop work, the apprentices are also obliged to take a course in the evening classes of the Rhode Island School of Design in Providence or the course in mechanical engineering and drawing of the International Correspondence Schools, of Scranton, Pa. Our apprentices come from all parts of the country, and many have come from Europe to get the benefit of the training afforded by our system.

Thus far our experience shows that the young men who have completed the full term of apprenticeship under this system are vastly superior to the ordinary shop-trained mechanics, and wherever they go their technical training, combined with the knowledge of our system of manufacturing, enables them to secure better positions and higher wages than the average mechanic. The majority rise to responsible positions as foremen and superintendents, and many of them have become members of firms and manufacturing corporations.

The terms and agreement of apprenticeship are as follows:

Terms of apprenticeship to the Brown & Sharpe Manufacturing Company, manufacturers of fine machinery, machine tools, etc., Providence, R. I.

Applicants for admission to apprenticeship must be not less than sixteen nor more than eighteen years of age. They must be physically sound, of good moral character, and have received an education equivalent at least to that required for graduation from the public grammar schools of the city of Providence.

Application must be made in person, and, if accepted, the applicant's name will be registered and due notice given when he will be required to commence work.

The first four hundred and eighty hours of service shall constitute a term of trial. If the apprentice shall during this term prove satisfactory, and shall before the expiration thereof execute, together with his father or guardian—or if he have no father or guardian, then with some other responsible party—an agreement in the form hereto annexed, then his apprenticeship shall continue for the full term, unless sooner terminated as hereinafter stated.

Apprentices will be required to serve for the term of four years, each year to consist of two thousand nine hundred and fifty working hours, which, with the usual working day of ten hours each, is equal to two hundred and ninety-five working days. The remaining working days in each year will be allowed apprentices for recreation, at such time or times as the company shall direct.

Graduates of the Providence Manual Training High School, well recommended by the principal, may have their term of apprenticeship shortened, at the discretion of the company.

Apprentices will be required to perform their duties with punctuality, diligence, and fidelity, and to conform to the rules and regulations which are or may be adopted for the government of the shops.

Apprentices are not allowed to use tobacco in the shops during working hours.

Apprentices shall make up lost time at the expiration of each year, at the rate of wages paid during said year; and no year of service shall commence until the apprentice shall have fully made up all time lost in the preceding year.

The company reserves the right, whenever the state of business demands it, to shorten the hours of labor, or whenever for any reason it shall stop the works, to suspend apprentices wholly or in part, and the making up of time so lost shall be at the discretion of the company.

The company also reserves the right, in its sole discretion, to terminate its agreement with any apprentice, also to discharge him from its employment for nonconformity with its rules and regulations, want of industry or capacity, indifference to his duties, or improper conduct within or without the shops.

Apprentices will be paid for each hour of actual service (not including time allowed for recreation or time when work is suspended) the following wages: For the first year, 6 cents; for the second year, 8 cents; for the third year, 10 cents, and for the fourth year, 14 cents. If the company shall terminate the apprenticeship during the time of trial, it will pay at the rate of 6 cents per hour for the time worked.

Wages will be paid on the regular pay days of the company as they may be established from time to time.

The company will faithfully instruct the apprentice in the machinist's art and trade in their shops during the term of apprenticeship.

Agreement made this —— day of ——, A. D. 1—, between the Brown & Sharpe Manufacturing Company, a corporation established in the city of Providence, in the State of Rhode Island, party of the first part; ——, of ——, party of the second part; and ——, of ——, party of the third part.

Whereas the party of the second part is desirous of becoming an apprentice to the party of the first part for the purpose of acquiring the art or trade of machinist, now this agreement witnesseth:

That the party of the first part, in consideration of the covenants herein contained on the part of the party of the third part, hereby accepts the party of the second part as an apprentice in the art or trade of machinist, subject to and in accordance with the "Terms of apprenticeship," which are hereto annexed and made part hereof.

The party of the second part, in consideration of such acceptance, hereby agrees to become the apprentice of the party of the first part in the machinist's art or trade in accordance with the said "Terms of apprenticeship" and to faithfully conform to the provisions thereof.

The party of the third part, in consideration of the covenants on the part of the

party of the first part herein contained, for himself, his heirs, executors, and administrators, covenants with the party of the first part that he will pay the party of the first part, as compensation for receiving the party of the second part as an apprentice, the sum of fifty dollars ($50), said sum to be paid at the expiration of the term of trial referred to in said "Terms of apprenticeship."

The party of the third part, for himself, his heirs, executors, and administrators, covenants and agrees, to and with the party of the first part, that the party of the second part shall well and truly conform to and abide by all the provisions of said "Terms of apprenticeship" and of this agreement.

The party of the first part covenants and agrees, in case the party of the second part shall serve the full term of said apprenticeship (including the making up of lost time) as provided in said "Terms of apprenticeship" and shall in all respects comply with the provisions of said "Terms of apprenticeship," to pay to the party of the second part at the termination of said term of apprenticeship, in consideration of such faithful service, the sum of one hundred and fifty dollars ($150).

In witness whereof the parties hereto have hereunto set their hands and seals (the party of the first part by ——, its ——, duly authorized for that purpose) the day and year first above written.

Executed in the presence of—

—— ——.

MILLINERY.

The manager of a prominent millinery establishment in New York City furnishes the following statement regarding experience with young women who have attended millinery schools:

We have employed a large number of the graduates of local millinery schools and their work has always proved satisfactory. At certain seasons of the year there is a large demand for makers, improvers, and trimmers in the trade, and until the schools were established we had great difficulty in obtaining an adequate supply of experienced hands.

The element of design is the most important factor, but workmanship can not be neglected. More schools would be a benefit to the industry. As American milliners advance in the creation of styles they will to that extent lessen the necessity of looking to Paris and other fashion centers for models and special features, and this advance may be brought about by good schools. School training develops the native artistic taste to much better advantage than can be done in the shop, and it also reveals the defects in the student and thus often turns the girl to some other pursuit for which she is better fitted, and saves the business from some, at least, who never would become competent milliners.

We prefer graduates of schools when we can get them. They do just as good work as the shop-trained milliners, and as a rule they are more reliable and make a better class of help. The proprietors of the schools vouch for the young women, and a recommendation from the school is a sufficient guarantee to us that they are of good moral character and can do good work. We are especially interested in getting good milliners, as we have a constant demand from our trade throughout the country for experienced help. We employ the graduates for one or two seasons, until we know just what they can do, and then send them to fill positions with our customers—milliners who buy our trimmings, shapes, etc. Hardly a year passes but that we

find good paying positions for from 50 to 100 milliners in this way. Our trade looks to us for experienced help, and we look to the schools. Thus far the plan has proved highly satisfactory.

We have a systematic course for beginners in our workrooms, and every branch of the trade is taught thoroughly. We prefer, however, to employ the school-trained help, as they have already learned the preliminary parts of the trade and make rapid progress in the art of trimming.

A statement substantially of the same character as the foregoing was furnished by the manager of the millinery department of a large department store in St. Louis, Mo.

PRINTING AND PUBLISHING.

In that branch of the printing business which employs the greatest number of workmen—that is, typesetting—the apprentice who has a good graded school education can learn the art much better by starting in at the case in a regular printing establishment. School-trained compositors are said to do good work, but they possess no special qualifications which give them preference over those who have obtained their training by actual work in the trade.

In the lithographing and engraving branch of the industry a number of concerns employ graduates of industrial art schools in the drawing and designing department. The proprietor of one of these establishments speaks as follows:

Ten of the workmen in our designing room have studied in a local institute which has a four-year course in industrial art drawing. Some of them pursued their studies in the evening classes while working in the shop during the day, thereby combining the theoretical and artistic instruction with practical work under shop conditions. The special training of these men has been a great benefit to our business, the work of some of them resulting in increasing the amount of our product at least 10 per cent. Our workmen start in at the bottom and are promoted according to their ability. Those who attend the evening classes at the institute advance faster and are more proficient, and they receive higher wages than the mere shop-trained workmen.

Further provision for industrial art schools would be a benefit to the industry generally. The best results are attained when school training is combined or supplemented by shop training. The latter is absolutely necessary in order that the workman may obtain that practical knowledge which is essential to success in the business.

We require a formal stage of apprenticeship in important occupations, but shop training alone does not give the apprentice all the instruction he requires and should receive. We therefore stipulate that our apprentices must be graduates of the local institute. The results so far have been very gratifying and, in our opinion, demonstrate the superiority of the system that we have adopted.

On the need of such schools a circular issued by the North End Union, of Boston, about the time its school of printing was started, and

signed by a number of prominent printers and publishers of the city of Boston, says:

Printing, in common with other trades, has suffered from the decadence of the apprenticeship system, in which master and apprentice worked side by side. The work has largely become specialized, the choice or selection of method and style and the responsibility for artistic qualities in printing now resting principally with the designer or foreman, and hardly concerning the compositor at all. This has weakened that self-reliance which comes from experience and retarded the individual development of the artistic sense in printing, and it is to-day difficult to find, in numbers equal to the demand, efficient, all-around, artistic printers.

In general, it may be said that the trend of modern trade conditions is to emphasize that which is merely mechanical and to restrict more and more the opportunities for acquiring that which is artistic. In view of these facts, we believe that adequate instruction in thoroughly good printing can better be given in schools properly equipped and under competent direction than in our modern printing offices.

A stage of formal apprenticeship is required in all occupations in each branch of the industry. The trades most largely represented by labor unions are compositors, pressmen, press feeders, bookbinders, lithographers, and engravers.

SCIENTIFIC INSTRUMENTS.

The following statement was furnished by a prominent manufacturer engaged in this branch of industry:

We have several graduates of a local technical school in our employ, besides a number of workmen who are attending evening classes in the same institution. The special training and scientific knowledge that these men obtained in the school has undoubtedly helped to improve the character of our product. They have steadier employment and receive 10 per cent higher wages than the other workmen. Our school facilities are first class in every respect, and afford every modern means for instruction in the arts and sciences applicable to our industries. We have considerable difficulty, however, in making our workmen understand the importance of attending the school. We need technical men in our business, and have room for twenty to-day, but can not find them. They are slow and awkward at first, but after working a while in the shop they learn our methods and make good progress. The average mechanic is usually guided by the customs of his trade. He can execute the work when it is mapped out for him, but knows nothing about the technical and scientific principles which govern it. We need mechanics who have been trained to think as well as to work. The ordinary mechanic is too indifferent. He is satisfied with learning one or two parts and does not care to bother about anything else. When the technical man comes into the shop he works hard to get a practical knowledge of minor details, and when that is acquired he pushes on to the higher and more difficult parts. The importance of obtaining a complete knowledge and mastery of his trade is instilled into his mind in the school, and he is ambitious to

get ahead, and with proper encouragement is bound to be more valuable both to himself and his employer. Our system of apprenticeship does not extend to the entire trade. The apprentice is simply taught how to run a certain machine, such as a lathe or planer. In this way he learns to be a good machine tender, but not an expert machinist. The class of men we need in this business ought to have a thorough knowledge of mechanical drawing, physics, and chemistry. These things can not be taught in the shop. They must be learned in some technical school.

There ought to be a rule making it compulsory for every apprentice to attend our evening trade and technical schools. It is a serious matter with us, and we are thinking of adopting some means whereby we can compel all our apprentices to take a full course of instruction in the local technical school. If we could have such an arrangement, we would be glad to change our apprenticeship system so as to give every boy a good training in every branch of the business.

SHIPBUILDING.

It is considered that the services of graduates of technical schools have in many cases been of great benefit in this industry. In the construction departments it is said that there has been a marked improvement in the character of the work performed by such workmen as have acquired a knowledge of mechanical drawing, while in the drafting department there are several cases where the ability of technical school graduates is referred to in the highest terms. The mechanics, draftsmen, and foremen who have attended these schools receive from 10 to 30 per cent higher wages than employees in similar positions who have had shop training only.

It is the opinion of employers generally that further provision for trade and technical schools would be a benefit to the industry. A formal period of apprenticeship is usually required.

Regarding the comparative merits of shop training and of trade-school or technical training, it is said that for ordinary mechanical work shop training is best, provided the system of apprenticeship is arranged so that the apprentice can serve part of his time in the drafting room. This system gives the apprentice a training in mechanical drawing that enables him to read and understand working plans, while the time spent in the construction department gives him a thorough knowledge of practical shop methods and qualifies him to do good work. Unfortunately, however, very few establishments have such a system in force. While they all recognize the importance of having their workmen trained in the art of mechanical drawing, yet, with few exceptions, the matter is left to the option of the workmen, who, when favorably inclined, pursue their studies either in some evening school or by means of the correspondence system. In the more important branches of the work and in positions requiring a high degree of intelligence and skill, the employers prefer those who have had both practical experience and technical training.

The molders, pattern makers, machinists, ship joiners, carpenters, and calkers are largely represented by labor unions.

SILVERWARE MANUFACTURE.

The following statement has been furnished by the superintendent of a large manufacturing silverware establishment in one of the Eastern States:

Altogether we employ five designers and ornamenters who have been educated in schools of design. Three have graduated from German schools, one from an English school, and one from the Drexel Institute in Philadelphia.

The special education of these workmen has undoubtedly helped to improve the character and quality of our product, and we pay them about 25 per cent higher wages than those who have had shop training only. Good design and good workmanship are both essential in this industry. While originality and excellence of design are always desirable, yet without good workmanship the product would find little demand in the market. More schools would be of no particular benefit to our establishment. If we could not get school-trained men, we would train our own workmen.

The education which is made up of a combination of shop and school training is best. If a boy brought up in a shop also learns to draw in a school of design, he is preferable to the school-trained boy who has no shop experience. Practical shop training is always essential. The school-trained boy lacks this and takes it hard when he tries to get it. He is disposed to think at the start that he knows more than they do in the shop, and consequently is not of much use until he unlearns some of the things taught in school. We require a formal stage of apprenticeship in silversmithing, engraving, spoon making, chasing, die cutting, burnishing, molding, turning, and designing. All our apprentices receive full and adequate instruction. This is given in the ordinary course of shop work, but we are careful that they shall have a thorough all-round education in the trade. Those who are learning design also attend evening classes in a local school of design.

TEXTILE INDUSTRIES.

While manufacturers in the industries differ in their opinions as to graduates of schools of design, they are practically agreed that the special training afforded by textile schools has been a benefit both to the industries and to the graduates who are employed in the mechanical departments in the mills. Generally speaking, except in the production of plain cloths, flannels, etc., design and workmanship are equally important in commanding a market for the product. But excellence in workmanship is much more easily attainable than originality and attractiveness of design. In the manufacture of plain goods superior workmanship is deemed most essential.

Inasmuch as the supply of school-trained designers is at present much larger than the demand, it is thought that the industry is in no danger of suffering from a lack of schools of design. In the manufacturing branches, however, there is a decided sentiment in favor of

further provision for textile schools. Many think that the textile industries are already suffering from the lack of institutions of this kind, and the manager of one mill in Massachusetts states that they are greatly needed if American manufacturers are to compete successfully with foreign-made goods.

Regarding the comparative merits of shop training and of trade-school or technical training, it is said that practical experience in the mill is always necessary, as school training alone does not make a finished workman. The manufacturers generally prefer shop-trained designers, and those employed in the mills are men who have spent many years in the designing room before they became proficient. The theoretical and artistic side of designing can be learned only in some good art school or school of design, as no mill has adequate facilities for giving thorough instruction of this kind. But the technical and practical side of the work must be acquired in the designing room. When a graduate is first put to work in the mill he starts in as a finisher; that is, he must be able to take a section of a design made by a designer and extend and complete it. It may therefore be said that for a finisher of designs school training is of paramount importance, but before he can become a full-fledged designer, capable of producing original and practical working designs, years of experience in the designing room are necessary.

Two of the largest silk manufacturers in the country state that they have purchased many good designs from young women who have studied designing in some of the New York schools, and particular mention is made of their superior work in making designs for decorative silks. One of these manufacturers states that the young women graduates, who are known in the industry as "outside designers," seem to be specially adapted for work of this character and some of them have met with very flattering success. In the mechanical operations, and particularly in weaving, the workmen who supplement their shop training with a technical course in a textile school become most valuable and useful to their employers, and ultimately attain higher positions and receive better wages than those who have shop training only.

One mill requires an apprenticeship of seven years for engravers and sketch makers. All others report that there is no fixed period of apprenticeship in mill occupations. It is said to be almost impossible for a boy to obtain thorough instruction in a mill. The exigencies of the business are such that he merely learns to tend a machine and nothing more. Consequently when anything goes wrong he is at a loss for a remedy. In the case of a weaver it usually requires four years for him to become a full-fledged workman, and even then he has not the ability to overcome difficulties and to get around emergencies without calling upon others to assist him. It is in such things as these

that the school-trained workman shows his superiority, as the training given in the school covers every part of the work and also includes technical instruction in the construction, operation, and care of the loom. The textile trades most largely represented by labor unions are the carders, loom fixers, spinners, and weavers.

WALL PAPER.

The graduates who usually find employment in this industry are those who pursue their studies in art schools and schools of design. While none of the manufacturers report giving permanent employment to the school-trained designers, yet there are several who state that they have purchased designs from "outside designers," a term applied to a large class of designers, mostly young women, who have studied in some school of design, and who make up designs for wall papers, textiles, etc., on their own account and sell them to the manufacturers in these industries.

It seems to be the general opinion in the wall paper industry that the most of the designs made by this class of designers are not practical. The superintendent of one large concern who has handled wall paper designs for more than thirty years, says:

In this industry the command of the market is due entirely to the element of design. The industry would undoubtedly be benefited if the instruction given in the schools were made more thorough and practical. We have done everything possible to encourage the schools and the graduates, and our interest in their work has at times led us to purchase designs which we knew could not be used without alteration. This was done in the hope that the schools would improve and become more practical in their methods of instruction. We have purchased designs from more than fifty school-trained designers, not more than 5 per cent of whom can be classed as successful designers.

The school-trained designers make very pretty designs, and some of them are quite original. But they all show that lack of factory experience which gives the designer a knowledge of the mechanical part of the work, and also an idea of trade conditions, both of which are necessary and must be anticipated when a design is being made. We employ no female designers in our factory because the work is extremely difficult and requires unlimited and constant application, and they are not physically strong enough to stand the strain. We prefer to purchase their designs and have our own men change them and make them practical when necessary.

A formal stage of apprenticeship is usually required in all occupations in this industry, and it is said that the apprentices receive full and adequate instruction in each part which is given in the ordinary course of shopwork.

WATCHMAKING AND REPAIRING.

Generally speaking, the trade or technical school training of workmen who are employed in watch factories has had no particular effect upon either the character or the quality of the product. While men

with such training are able to do a given amount of work in a shorter time than the shop-trained workmen, their work is no better and they receive no higher wages than the others. They are better all-round workmen, but owing to the subdivision of labor which prevails in the factory, watchmakers are no longer needed. Watch workers, men who are skilled in a particular part, are necessary, and it is said that such men can get better training in the factory.

In the repairing branch of the business, however, school trained men are recognized as doing more and better work, and receive from 10 to 50 per cent more wages than those who have had no trade-school training.

Additional trade or technical schools would benefit the manufacturing branch of the industry only to the extent that more adequate educational facilities would tend to improve the general intelligence of the workmen.

In the repairing branch it is thought that additional schools would be an advantage to the workman as tending to improve the general character of his work. One employer states that the demand for technically trained men is much greater than the supply, which is attributed at least in part to the lack of proper schools. There are some things which can only be learned by practical shop experience, but for general all-round work the man who has learned the trade in a school gives the best satisfaction. Such shop knowledge as is necessary can be acquired in a short time, but the technical instruction given in the school will rarely be obtained in the shop. One employer is of the opinion that a young man can learn more in one year in the school than he can in four years in a shop.

In the factory branch of the business no formal stage of apprenticeship is necessary. The workmen are started at the lower orders of work and advanced systematically through the different operations as individual ability warrants. In the repairing branch the tendency among employers is not to take apprentices when trained help can be secured. Those who take apprentices state that there is no limit as to time. The training is practical, but the theory of the trade is not taught at all. The progress of the apprentice all depends upon his ability and the interest manifested by his employer.

ATTITUDE OF GRADUATES OF TRADE AND TECHNICAL SCHOOLS.

ARCHITECTURAL DRAFTSMEN.

Among the graduates reporting for this occupation all state that they had a taste for drawing and that they attended school to perfect themselves in architectural work, so that they might follow it up for a livelihood. The majority secured employment immediately upon graduation, and several report that the school authorities exerted

themselves in their behalf. While there is no fixed term of apprenticeship, it is stated that the period which all beginners must serve "under instructions" was, in their cases, shortened by from one to two years. With one exception the graduates agree that their school training has resulted in higher wages, steadier employment, and more rapid promotion than would have been the case otherwise.

On entering an architect's office most of the graduates were obliged to work one year "under instructions" without wages, after which they were advanced according to their ability, their wages ranging from $6 to $10 per week during the second year to $18 per week in the fourth year after graduation. They are all in favor of trade or technical education for those who have a desire to engage in industrial work. One graduate says: "A course of training in any school that will give a boy a knowledge of a trade or occupation is sure to be beneficial and will give him a better chance to succeed."

BARBERS.

Of the graduates of barbers' schools reporting, some secured employment immediately upon graduation, while others failed to do so. Those who did not, assign such reasons as "too young to make favorable impression upon employers," "could get better pay at other work," "went into business for myself," etc. Generally they do not feel that their school training assisted them in obtaining work, and the schools as a rule gave no aid in securing situations. There is a strong prejudice against barbers' schools on the part of employers, and the fact that a young man has attended one is rather a hindrance than a help in procuring a position. Therefore a great number of graduates set up shops of their own. Unions generally oppose the schools and do not recognize their work.

Attendance at the schools shortened the time necessary to become proficient barbers, but did not enable them to secure higher wages than are paid to other good barbers.

About one-half of the graduates reporting say they would not recommend barbers' schools as they are now conducted; that the course of study does not cover sufficient time to afford opportunity for the necessary practical work; and that barbers' schools are in such disrepute among barbers that their graduates do not stand an equal chance with shop-trained barbers. Those who would send their sons to barbers' schools would do so only to save time, and also that they might learn things of a professional character which can not be learned in a shop.

BREWERS.

In every instance the graduates who are engaged in the brewing industry state that after working several years in the various parts of a brewery they found that in order to attain higher positions in the trade it would be necessary for them to attend a brewers' school. All

secured employment immediately upon graduation, and the fact that they were graduates proved of great assistance in procuring employment in a higher capacity and at greater remuneration than would otherwise have been the case.

There is no regular system of apprenticeship in the industry. Most of the foremen and brewmasters are men who have worked their way up from the lower branches, in which they obtained a practical knowledge of the business, which has been supplemented with a course in some brewers' school.

In every case the school training received by the graduates has resulted in their obtaining steadier employment and more rapid promotion than would have been the case otherwise. Before attending school most of the graduates were employed as cellarmen. After completing the school course they secured employment as head cellarmen, foremen, or assistant brewmasters, at wages ranging from $1,200 to $2,000 per annum, and in the course of four or five years they were advanced to the position of superintendent or head brewmaster, in which occupation they receive from $3,000 to $5,000 per annum. It is the unanimous opinion that a young man who desires to become a first-class brewmaster should have the benefit of the technical training which is afforded by the brewers' schools. The brewmaster must have a thorough knowledge of every detail from the time the raw material enters the brewery until the finished product is placed upon the market, so that in case the latter should prove unsatisfactory he may know where to look for the cause and be able to apply the proper remedy.

Before the brewers' schools became popular the operations in brewing depended very largely upon guesswork, and there was always more or less waste from over-fermentation, loose methods of handling, etc. But the theory of fermentation is now understood, the cooling, storing, bottling, and handling of the product has been reduced to a science, and every detail from beginning to end is fully covered by the course of instruction given in the schools.

BRICKLAYERS.

Two of the workmen interviewed in connection with this trade were negroes who attended one of the schools in Philadelphia. They gave as their reason for taking a course of instruction in the trade that they wanted to learn bricklaying, but, owing to their color, they could not get an opportunity to do so outside of the school. The white workmen gave as their reasons that they believed that the trade could be learned more quickly and thoroughly by attending a trade school. All secured employment immediately upon graduation, and in most cases they were aided by the school authorities. The fact that they were able to do satisfactory work was the most potent factor in obtaining employment.

A period of apprenticeship is required in the trade, but in no case did any of the graduates serve the full period. Some were able to procure positions as skilled workmen at once, and others served an apprenticeship which was two years shorter than the regular term. In every instance their trade-school training has resulted in great benefit. Those who were obliged to serve an apprenticeship received $1.50 per day the first year, and from this amount their wages advanced to $3.50 and $4.40 per day the third year after leaving school. About one-third of the graduates are members of labor unions. All say that any boy who has an inclination to learn a trade ought to have the benefit of a trade-school training.

In speaking of the schools for negro youths, one of the graduates says: "If it were not for the trade school I would be nothing but a common laborer. The school gave me the chance to learn a good trade, and I look upon it as a great blessing to our race. It has helped many of our people to obtain good positions and made them self-supporting and better men."

BUTTER MAKERS.

Graduates of dairy schools are usually employed as superintendents of creameries. They attend the schools to study the scientific principles of butter making and to get a knowledge of such details of the trade as can rarely be learned in the commercial creamery. It is essential for a successful butter maker to know the breeding, feeding, and care of dairy stock, and this can not be learned in a dairy.

The schools always have applications for more men than can be supplied, and their recommendation is a sure guaranty for a position. The graduates, therefore, find ready employment in a high capacity and at good wages.

No apprenticeship is required of school graduates, but the graduates who furnished information for this report state that they were required by the schools to have worked one season in a creamery before they were admitted to the schools. There is no fixed period of apprenticeship in the trade, but such service is required of persons who have not attended schools as will make them acceptable workmen. This period is from one to two years longer than that required of those who have taken a course in a school. There are no labor unions in the trade, and terms of apprenticeship and rates of pay are adjusted between employers and each individual employee.

Every school graduate furnishing information is a fast friend of the schools and would send his son to one if he expected him to become a butter maker. They say a boy will not only get a knowledge in the schools which he can not possibly get in a factory, but that the things he might learn in the factory are more thoroughly learned in the schools and in a much shorter time. The school trains the student to

think, and instills the habit of looking for the reason of things. He is, therefore, better prepared to profit by any subsequent experience in the factory.

CARPENTERS.

Several of the persons furnishing information had learned the practical part of the trade before attending school, and their object in taking a course of instruction was to acquire a knowledge of architectural drawing and the theoretical principles of the trade. The others preferred this method of learning the trade. Those who were not already engaged secured employment immediately upon graduation, and in most cases the fact that they were graduates of a trade school proved of assistance in obtaining employment in a higher capacity and at better wages than would have been possible otherwise.

More than one-half of the graduates were compelled to pass through a full period of apprenticeship before being engaged as journeymen, not many being able to procure positions as trained workmen. All agree that their trade-school training has resulted in higher wages, steadier employment, and in some cases more rapid promotion than they would otherwise have received. The wages received by those who were obliged to serve an apprenticeship after leaving school ranged from $1.50 per day for the first year to $2 per day in the second year, and $2.50 to $3 in the third and subsequent years. Only a few report that they are members of labor unions.

Regarding the question of sending a boy to a trade school to prepare for a trade, it is said that under the modern system of apprenticeship no boy can learn every branch of the trade by shop work alone; that a boy who aspires to be more than an ordinary workman must possess a clear knowledge of the scientific principles pertaining to his trade, to obtain which he must have the benefit of such instruction as is given in the recognized trade and technical schools; and that even though he is obliged to serve an apprenticeship after leaving school, he will receive higher wages to start with and will stand a better chance for promotion.

DESIGNERS OF ART NOVELTIES, HOUSE DECORATIONS, STAINED GLASS, ETC.

Most of the graduates furnishing information under this head are women. Some had a liking for art work, but in the majority of cases the main object in taking a course of instruction in a school was to learn some branch of industrial art which would enable them to earn their own living. They had no trouble in securing employment after completing their studies, and with few exceptions received assistance from the school authorities. All but two state that the fact that they were graduates resulted in their obtaining employment in a higher

capacity and at a greater remuneration than would otherwise have been the case. They were fully prepared to engage in practical work on leaving school, and no apprenticeship was required. The wages they received ranged as follows: First year, $9 to $15 per week; second year, $13 to $16 per week; third year, $15 to $20 per week; fourth year, $17 to $25 per week; fifth year, $20 to $30 per week. They were unanimous in saying that their school training has been of great advantage to themselves, and they all believe that a similar course should be pursued by those who desire to engage in industrial designing.

DESIGNERS OF TEXTILES.

Of the 15 graduates contributing information for this trade 5 are women. Various reasons are given for taking a course of instruction in the trade. Most of the men had previously been engaged in different departments of textile mills and wanted to learn designing so that they might be able to obtain higher and better-paying positions. Others desired to learn the trade, but found that in order to get employment in a designing room it would first be necessary to acquire a knowledge of the theoretical and artistic side of the work in some school of design. All of the women designers had a natural inclination for art work, and as industrial designing offered the best opportunities for the employment of their talents they concluded to follow it up for a livelihood. With one exception, those not previously engaged had no difficulty in securing employment upon completing their studies, and as a rule they were assisted by the school authorities. In every instance the fact that they had completed a course in textile designing in a reputable school resulted in their obtaining employment in a higher capacity and at greater remuneration than would otherwise have been the case.

A period of apprenticeship is usually required, and a majority of the graduates were obliged to serve several years as finishers of designs before being engaged as regular workmen. In some places it is thought that the period of apprenticeship required of graduates is unduly prolonged by the chief designers. None of the women designers served an apprenticeship. One of the latter is an "outside designer," who has built up a profitable business in making designs for decorative silks, etc., which are disposed of among the manufacturers. The others are designers of oriental rugs, and they were qualified to engage in regular work immediately upon graduation.

With one exception, the graduates were very enthusiastic in speaking of the benefits derived from their school training. Most of them admit that if it had not been for the instruction they received in the school it would have been impossible for them to engage in the work of designing at all, as they could not get a chance to learn the trade in a designing room. There was considerable variation in the wages they received after entering upon the work of the trade. One man worked two

years without wages as a finisher of designs, after which he was considered a competent designer and received from $900 to $1,500 per year for several years, and later on was advanced to $3,000 per year. Another person worked seven years as a finisher, during which time he received from $3 to $15 per week, and upon becoming a full-fledged workman his wages were gradually increased to $40 per week. Still another, who was evidently more proficient than the rest, was able to command $1,200 the first year after graduation. The women designers started in at wages ranging from $10 to $18 per week for the first year, $12 to $25 per week for the second year, and $15 to $30 per week for the third and subsequent years.

While there is some diversity of opinion regarding the course to pursue in order to obtain the best results from a school training, all agree that a thorough understanding of the theoretical and artistic principles of the trade is absolutely necessary, and that this can best be gained by attending some good school. Practical experience in a designing room is essential to develop the perfect designer, and it is said that the most successful workmen are those who have had the benefit of both kinds of training. Some are of the opinion that school training should precede practical training, while others believe that a boy ought to have a few years' experience in a mill before attending school. This, it is said, would enable him to grasp the details of practical work more quickly and give him a decided advantage over the young man who has only a school training with which to start.

In referring to the advantages of school training as compared with shop training, one designer who has met with good success in the trade says:

A school of design affords the only means for learning the trade in a reasonable time. A boy learning the trade in a designing room wastes much valuable time in doing drudgery for the designer, who is usually averse to giving instruction on the important points of the trade, which must therefore be learned, if at all, by observation. In the school the student has the benefit of the experience and knowledge of many men, or a concentration of the best ideas in the trade. He receives careful instruction in the fundamental principles of industrial art, their practical application to the work of his trade is fully explained, and he is afforded every opportunity for becoming proficient without waste of time.

DOMESTIC SERVANTS.

One of the graduates in domestic training gave as her reason for taking a course of instruction in school that she saw her way clear to fit herself for nothing better than domestic service and she believed the training she would receive at school would be better than any she could obtain in any other way. Another stated that she liked domestic work, and believed that with the school training she could obtain a

better position. They both secured employment immediately upon graduation. The school authorities actively exerted themselves in assisting them to positions, and the fact that they were graduates of a training school proved of assistance in securing employment in a higher capacity and with greater remuneration than would have been possible otherwise. Each thought the school training much more thorough than that received in actual service, and in the light of their own experience they would recommend a similar course for all young women who desire to enter domestic service.

DRESSMAKERS.

A number of those furnishing information for this trade had been employed in dressmaking establishments previous to attending the trade school. Their object in taking a course of instruction was to learn the trade in its entirety. In common with many others they had found that employing dressmakers were disposed to withhold instruction from their apprentices, especially in the art of cutting and fitting. Another important reason which most of them gave was that they wanted to learn the trade so that they might follow it for a livelihood. Those who did not engage in business for themselves found employment immediately upon graduation, and the recommendation of the school was of great assistance in this direction.

The term of apprenticeship in this trade varies according to the aptitude of the individual and the disposition of the employer to give instruction. No apprenticeship is usually required of school graduates. Those without previous experience begin at a low rate of wages and are advanced according to their ability. Generally speaking, their trade-school training has resulted in higher wages, steadier employment, and more rapid promotion than would have been the case otherwise. The wages received after leaving school ranged from $3 to $8 per week for the first year, $5 to $12 per week for the second year, and $6 to $15 per week for the third year. Those who took up cutting and fitting exclusively were able to command from $16 to $25 per week for the first year, and one who had exceptional ability was receiving $50 per week the fourth year after completing her studies in the school.

The general sentiment of the graduates is decidedly favorable to trade education, and they believe that those who desire to learn the trade should take a course of instruction in some good school, as it is almost impossible for a young woman to learn the entire trade in the workroom.

ELECTRICAL WORKERS.

Two graduates in electrical courses gave as their reason for taking a course of instruction in a trade school that they wanted to learn a trade, but could not get a chance outside of the school. Another stated

that he was influenced to attend the school by the fact that the electrical industries were practically in their infancy, and as he desired to follow some branch of the work he concluded that the best course to pursue would be to acquire a knowledge of the theoretical and scientific principles before engaging in practical work. With one exception, employment was secured immediately upon graduation, and the school training proved of assistance in this connection. Two were compelled to serve apprenticeships before being engaged as qualified workmen, but the term was one year shorter than that required of nongraduates.

All agree that their trade-school training has been a benefit to them, and in a general way has resulted in higher wages and steadier employment. Upon engaging in practical work their wages ranged from $4.50 to $10 per week the first year, $6 to $11 per week the second year, and $8 to $12 per week the third year. They believe that every boy should be sent to a trade school to prepare for a trade. School training alone will not make him a finished workman, but it will make his task much easier when he engages in the actual work of his trade.

GARMENT CUTTERS.

Graduates of cutting schools state that they found no difficulty in securing remunerative positions, and in most cases the fact that they had completed a course of instruction in such schools proved of assistance in obtaining employment. Some of the persons had had more or less experience in the trade before attending school, but not having any regular system for cutting they took a course of instruction for the purpose of learning one. Others had been employed as sewing tailors and not being able to get a chance to learn cutting in a regular shop they went to the school for that purpose. Two graduates were obliged to serve an apprenticeship, but in each case the term was one year shorter than the regular period. They received $9 per week for the first year and $15 per week the second year after graduation. Those who were not obliged to serve an apprenticeship were able to command from $15 to $25 per week the first year, $18 to $30 per week the second year, $20 to $40 per week the third year, and one was receiving $50 per week the fifth year after completing the school course. Two graduates report that they are members of labor unions. Generally speaking they are well pleased with their school training. The knowledge obtained in cutting schools has been invaluable to them, and they are of the opinion that every man who desires to become a master of the trade should take a course of instruction in some recognized school. In order, however, to secure the best results the student ought to have one or two years' experience in the trade before attending school.

ILLUSTRATORS.

All of the graduates furnishing information for this occupation are women who studied illustration for the purpose of following it for a livelihood. They secured employment immediately upon graduation, and the fact that they had completed a course of instruction in recognized schools enabled them to obtain better positions than would otherwise have been the case. None of them were required to serve any apprenticeship. Wages ranged from $8 to $15 per week the first year and from $10 to $20 per week the second year after leaving school. They all claim that their school training has resulted in unquestionable benefit to themselves, and are of the opinion that no person can become proficient in the art of illustration without taking a course of instruction in some good school.

MACHINISTS.

Quite a number of the graduates who are engaged in this occupation attended trade or technical schools which gave instruction in the theory and science of the trade as well as in the practical shopwork. This class of graduates desired to obtain a thorough knowledge of the fundamental principles of the trade before engaging in actual work. Several state that not being able to get a chance to learn the trade in a shop their only alternative was to attend a trade school. On the other hand there are those who after working in a machine shop for several years came to the conclusion that the theoretical and scientific instruction afforded by the evening trade and technical schools would enable them to obtain higher wages and advance to more responsible positions, and it was with this object in view that they attended these schools, while continuing to work in the shop during the day. Those who had not been previously engaged in the trade were able to secure employment immediately upon graduation, and several report that they were aided in this by the school authorities. In a number of instances it was said that the fact that they were trade or technical school graduates had some influence in their obtaining employment in a higher capacity and at greater remuneration than would otherwise have been the case.

The term of apprenticeship is four years, and about one-half of the graduates were required to serve the full period. The others were allowed a reduction of from one to two years, and in no case did the labor unions object to the shortening of the period. Generally speaking, the trade or technical training received by the graduates resulted in steadier employment, higher wages, and more rapid promotion than would have been the case otherwise. There was but one dissenting opinion in this connection, and it might be added that this same graduate deplored the fact that he did not pay more attention to his studies when in school.

In order to present a clearer idea regarding the progress of the graduates, in so far as it can be measured by the wages they received for a series of years after leaving school, the range of weekly wages of those who were obliged to start in as apprentices is given separately, as follows: First year, $3.38 to $6; second year, $4.80 to $10; third year, $5.40 to $12; fourth year, $7.20 to $15; fifth year, $10.80 to $15; sixth year, $15; seventh to tenth years, inclusive, $18.

Those who worked at the trade during the day while attending night school were qualified as journeymen immediately after leaving school, and consequently received higher wages than the others. The weekly wages of this class were as follows: First year, $9 to $15; second year, $11 to $18; third year, $13 to $18; fourth year, $15 to $18; fifth and sixth years, $16.50 to $18; seventh year, $16.50 to $23; eighth to tenth years, inclusive, $18 to $23.

About one-third of the graduates report that they are members of labor unions. They are practically of one opinion regarding the importance of trade education, agreeing that every boy who has a taste for mechanical work and wants to learn a trade should attend a trade or technical school. A technical education, combined with practice in the trade, enables a man to know and understand what he is doing. It makes him more valuable to his employer, and he will make better progress and eventually attain a higher position. It is said that every machinist should have a thorough knowledge of mechanical drawing, but that this must be acquired outside of the shop. Two graduates state that they were so well pleased with their success after completing a course in mechanical drawing that they concluded to study mechanical engineering. One of these men graduated from the Cooper Union in 1891, and is now studying by the correspondence method, which he has found to be entirely satisfactory.

MECHANICAL DRAFTSMEN.

Of the 40 graduates reporting for this occupation, 28 state that they wanted to take up mechanical drawing as a trade and believed that they could obtain better instruction and acquire a more thorough knowledge by attending a trade or technical school before entering a drafting room, and 12 report that having been employed in other occupations, which for various reasons were found uncongenial, they concluded to take up mechanical drawing as offering better opportunities for advancement. All but 4 secured employment immediately upon graduation, and in each case it was said that the fact that they had completed a course in mechanical drawing was helpful in this regard. Twenty report that the school authorities aided them in procuring positions and 15 state that no such assistance was needed. While the fact that they were graduates did not in the majority of cases result in their securing employment in a higher capacity or at greater remuneration immediately after leaving school, it is generally agreed that the

training and knowledge obtained in the schools has enabled them to advance more rapidly and ultimately to receive higher wages. Two-thirds of the graduates had no occupation whatever before attending school.

In some localities a regular apprenticeship of three or four years is required, and a number of graduates report that they were obliged to serve the full period before being engaged as competent draftsmen. In some cases there was a reduction of from one to three years made in favor of the graduates, and a few were qualified to take up regular work at once.

While in a number of instances it is stated that there was no period of apprenticeship, yet the wages that these graduates received when they first engaged in practical work and the system under which they were employed would seem to indicate that it practically amounted to the same thing. In such cases the custom is to take young men who have completed a course in mechanical drawing in some school and put them to work "under instructions" in the drafting room for two or three years and during this time they are paid wages ranging from $3 per week during the first year to $5 or $6 in the second year, and from $7 to $9 per week in the third year. Generally, at the expiration of the third year there was a noticeable increase in wages as the graduates became more proficient, the wages for the fourth year being about $12 per week. From this amount there was a gradual increase to $25 per week, in the tenth year, which seems to be the general maximum wages paid for this class of work. It frequently happens that when mechanical draftsmen reach the point where they can command $1,200 per year they take up mechanical designing, which is the highest and most important branch of the work and usually commands higher wages. There are exceptional cases where graduates have commenced at low wages and in the course of time have been able to command more than ordinary remuneration. This is shown in the case of a graduate of an evening drawing school whose progress is noted as follows: First year, $280; second year, $340; third year, $400; fourth year, $470; fifth year, $875; sixth to eighth years, inclusive, $1,000; ninth and tenth years, $1,200; eleventh and twelfth years, $1,350; thirteenth and fourteenth years, $1,500; and in the fifteenth year, $1,600. Some graduates who were evidently more proficient than the others were able to command from $600 to $1,000 the first year after leaving school. Most of this class, however, had been employed at mechanical work, usually in machine shops, before attending school.

All the graduates speak in the highest terms regarding the benefits they have derived from the instruction received in the schools, and the consensus of opinion is decidedly in favor of trade or technical education for every boy who desires to learn a trade. It is said that no boy can have too much of the right kind of training, and that when equipped

with a sound theoretical knowledge to start with his success is reasonably assured.

Some graduates favor the plan which makes it possible for a boy to engage in the elementary stages of practical work in a shop during the day while gaining theoretical instruction in a night school. Those who spent two or three years in mechanical work before entering school are strongly in favor of a similar course for others. In support of this plan it is said that a knowledge of machinery and mechanical work would generally give a young man a better idea of the things which are most essential for him to know, and he would consequently pay more attention to his theoretical training and take more interest in what he was learning. In this particular trade it is impossible in many localities for a boy or young man to obtain a position in a drafting room unless he has completed a course in mechanical drawing in some recognized school.

MILLINERS.

The young women furnishing information for this trade were actuated by a common purpose in taking a course of instruction in a millinery school; they wanted to learn the trade so that they might be able to earn their own living, and believed that the instruction afforded by the schools was more thorough and would enable them to learn the trade more quickly than it could be learned in a regular millinery establishment. Employment was secured immediately upon graduation, and in most cases the fact that they were graduates proved of assistance in this connection. All but one report that the school authorities helped them to procure employment.

On engaging in practical work no apprenticeship was required. Some started in as "improvers" at $5 per week and others as trimmers at $12 per week. All agree that their school training has proved beneficial and has resulted in higher wages and steadier employment than would otherwise have been the case. Generally speaking, they favor trade education for those who desire to learn the trade in its entirety. It is said that one of the most important things for a milliner to know is the artistic adaptation of shapes and colors so as to produce the best possible effect in meeting the requirements of each individual patron, and this part is seldom taught outside of a school. The instruction is more thorough in the school, and the teachers take a personal interest in the progress of the students. In the ordinary millinery establishment the apprentice does not receive the same attention and for the most part is left to pick up the trade as best she can.

PATTERN MAKERS.

Some of the graduates employed in this trade state that their only reason for attending a trade or technical school was that they wanted to learn the trade, and felt that they would be able to make better progress by learning the theoretical part first. A few report that

they desired to learn pattern making, but not being able to secure an opportunity in a regular shop, it was necessary for them to attend a trade school. Others state that after starting to learn a trade in a shop, they concluded to attend an evening technical school so that they might learn mechanical drawing and at the same time get a knowledge of the theoretical principles appplicable to the trade.

Most of the graduates obtained employment immediately upon graduation, and in some cases they were assisted by the school authorities. Several state that the fact that they were graduates of a trade or technical school resulted in their procuring employment in a higher capacity and at a greater remuneration than would otherwise have been the case. An apprenticeship of four years is usually required in the trade, but only in two cases was it necessary for graduates to serve the full term. A reduction of from one to two years from the regular period was allowed in favor of the other graduates, and this, it is said, did not meet with objection from the labor unions.

The graduates, with one exception, state that their trade or technical school training has resulted in higher wages, steadier employment, and more rapid promotion than would have been the case otherwise.

As in all other occupations, the wages received by the graduates after leaving school varied in different localities, according to the proficiency of the individual, graduates who were obliged to start in as apprentices receiving less than those who worked at the trade before attending school or those who were serving an apprenticeship in the shop during the day while going to school at night. The range of weekly wages for a series of years was as follows: First year, $4.50 to $15; second year, $5.75 to $15; third year, $9.75 to $15.50; fourth year, $12 to $19.50; fifth year, $13.50 to $19.50; sixth and seventh years, $15 to $19.50; eighth to tenth years, inclusive, $16.50 to $19.50. Only one of the graduates reports being a member of a labor union.

All are heartily in favor of school training for boys intending to engage in trades. It is said that the practical part of this trade must be learned by actual work, but there are many important things that the apprentice or journeyman can not learn in a shop, so that the school is almost a necessity.

PLUMBERS AND GAS FITTERS.

More than one-half of the graduates reporting for this trade had been employed either as plumbers or plumbers' helpers prior to taking up trade or technical instruction. Their object in attending the schools was to obtain a knowledge of theoretical principles which could not be acquired in actual work at the trade. The school sessions being held in the evening, they worked at the trade during the day, while pursuing their studies at night.

Those who had no practical experience before attending school believed that by taking a course of instruction they would be able to learn the trade much better and in a shorter time than it could be learned in the ordinary manner. This latter class found no trouble in securing employment as helpers after leaving school, and a few report that the fact that they were graduates enabled them to obtain better positions than would otherwise have been the case. They were compelled to serve an apprenticeship before being engaged as regular journeymen, but the period was from one to three years shorter than the regular term. Both classes of graduates are well pleased with the results of their school training. Some of those who had to serve an apprenticeship started as helpers at $6 per week, and others commenced as junior plumbers at from $12 to $16.50 per week for the first year, and in the second or third year they were able to command regular journeyman's wages, which varied in different localities from $18 to $22.50 per week. About one-half of the graduates report that they are members of labor unions.

There is a unanimous feeling in favor of trade or technical training for boys who are about to engage in trades. Some are of the opinion that the best results are attained when the school training is taken in conjunction with actual work in the trade during the time when a boy is serving his apprenticeship. Others think that a few years practical experience in the trade should precede the theoretical and technical instruction in the school. Modern sanitary methods and regulations have brought about many changes in the work of plumbing. Galvanized-iron pipe is taking the place of lead pipe in modern sanitary appliances, and in consequence there is not much lead work and the apprentice has little opportunity to learn the art of wiping joints, etc. The plumber of the present day needs to know more about sanitary requirements, and he ought to be well grounded in the theory of the trade. It is the general opinion that a thorough knowledge of these things can not be acquired outside of a trade or technical school.

PRINTERS.

Of the 6 persons furnishing information for this trade 5 are negroes who attended trade schools that were conducted for the special benefit of colored youth. They all wanted to learn the trade, and 3 state that owing to their color they could not get a chance to learn in a printing office. The white workman gave as his reason that he desired to obtain a practical knowledge of the trade in the shortest possible time, and he felt that he could make better progress by attending the school than by starting in a regular establishment. With the assistance of the school authorities all but one secured employment at the time of leaving school, and in every instance the fact that they

were graduates of trade schools enabled them to obtain higher and better paying positions than would otherwise have been the case. The white workman was obliged to serve an apprenticeship of two years before being engaged as a fully qualified workman. The first year he received $8 per week and the second year $10 per week. The colored workmen spent from three to five years in the school, and on engaging in practical work were not required to serve any apprenticeship. Their wages ranged from $6 to $7 per week for the first year, $7 to $9 per week for the second year and $8 to $12 per week the third year. None of the graduates belong to a labor union.

All state that their school training has resulted beneficially in every respect, and they are of the opinion that every boy should have a good trade-school education before engaging in the actual work of a trade. The white graduate says that a boy of average ability will get a better general knowledge of the trade in one year in a trade school than he can by working three years as an ordinary apprentice. The colored graduates are most enthusiastic in speaking of the advantages afforded by the trade schools which have been established for their race. It has always been difficult for colored boys to get an opportunity to learn a trade of any kind, but since trade instruction has been opened to them by the schools, it has been possible to engage in many occupations from which they had previously been debarred.

SHEET METAL WORKERS.

One of the graduates engaged in this trade was a journeyman before going to a trade school, and the others were serving their apprenticeship at the time they were attending evening classes. They all had the same motive in taking a course of school instruction, namely, to gain a more thorough knowledge than could be acquired by shop training alone.

The term of apprenticeship of those who were serving their time while attending school was from one to two years shorter than the regular period, and upon completing their studies they were able to secure employment as skilled workmen and received wages ranging from $21 to $24 per week. Their school training has been a great benefit to them, and they are of the opinion that a similar course ought to be pursued by every boy who desires to become a master of his trade.

TEXTILE WORKERS.

With one exception, the graduates engaged in textile occupations were already employed in mills when they entered the textile schools. Generally speaking, their chief object in taking a course of instruction in the trade was to obtain a theoretical as well as practical knowledge of the business, so that they might perfect themselves in the different branches and be prepared to fill higher and better paying positions.

The graduate who had had no practical experience previous to entering school was able, with assistance from the school authorities, to secure employment immediately upon finishing his course. It is said that it usually requires about four years' practical experience to become a competent workman, but none of the graduates, except two who had learned the trade prior to entering school, served the full time.

All agree that their school training has resulted in higher wages, steadier employment, and more rapid promotion than they would have otherwise received. After leaving school, some commenced as weavers at $8 per week and in the course of a year were promoted to loom fixers at $12 per week. Later on they were advanced to the position of second hand at $14 to $16 per week, and one of them, who studied in an English school, reached the position of overseer at $25 per week the ninth year after graduating. Others were qualified as loom fixers immediately and received $14 per week, while a few were able to procure positions as second hands at wages ranging from $13.50 to $18 per week for the first year.

Trade education is considered necessary for boys or young men who desire to engage in the different branches of the industry and to rise above the ordinary workmen. Practical experience in a mill is essential in all cases, but the theoretical and technical knowledge which fits a workman to fill the more responsible positions can be acquired only in a textile school.

WATCHMAKERS AND REPAIRERS.

One of the graduates reporting under this head is employed in a watch factory, and all the others are employed in retail jewelry establishments, where the greater part, if not all the work, consists of repairing. The usual reason assigned for taking a course of instruction in a trade school was that the trade could be learned much better and in a shorter time than by serving a regular apprenticeship. With the aid of the school authorities they were able to secure employment immediately upon graduation, and their qualifications made it possible for them to obtain better positions than would have been the case if they had not attended school.

While an apprenticeship of three or four years is usually necessary in the trade, none of the graduates was required to undergo any apprenticeship. Their school training is regarded as beneficial in every respect. After leaving school their wages ranged from $9 to $12 per week the first year, $10 to $15 per week the second year, $12.50 to $18 the third year, and $15 to $19.50 per week the fourth year.

The graduate who is employed in a watch factory states that if his son intended to follow the trade in a watch factory he would not send him to a watchmaker's school, for the reason that factory work does not require a man to be an all-round watchmaker, and he would in

time receive in the factory all the training necessary for his success. On the other hand, he fully agrees with the other graduates that if a boy is to follow the trade in a jewelry establishment he ought to be sent to a trade school, as in the repairing business a thorough knowledge of every detail is essential to success. Another important reason is that the trade can be learned in a trade school in one-half the time that is usually required in a regular shop. The schools teach all that is known concerning the trade, while in a shop it is impossible for the apprentice to get thorough instruction. It is said that the technique of the trade can be learned only in a good school, and that the school-trained man will rise higher and more rapidly than the merely shop-trained workman, and will have no difficulty in obtaining steady employment.

MISCELLANEOUS OCCUPATIONS.

Under this head are included graduates of ordinary trade and technical schools who have worked their way up from apprentices to higher positions as mechanical designers, foremen, superintendents, constructing engineers, and manufacturers. All of this class of graduates reporting pursued their studies in night schools, and more than one-half of them had either learned the trade of machinist or were serving their term of apprenticeship at the time they took up theoretical instruction in the schools. The reasons given for taking a course of instruction and training in the schools are practically the same as those which are reported under the head of machinists, the main object in all cases being to acquire a thorough knowledge of the theory and science of the trades in which they were already engaged or were about to enter. Those who were not already engaged in practical work secured employment upon graduation, and a few report that the school authorities exerted themselves in their behalf. They were required to undergo an apprenticeship before being engaged as qualified workmen, but the period was from one to two years shorter than the regular term. Some took up mechanical drafting for a trade, but the majority went to work in machine shops.

One of those who commenced as a machinist's apprentice received $4 per week the first year and $5.50 per week the second year. He was then advanced to machinist at $9, $10.50, $12, and $15 per week in the third, fourth, fifth, and sixth years, respectively, and in the seventh year was made foreman at $20.50 per week. Another began as an apprentice in a drafting room and received $10 per week the first year and $12 per week the second year. He was then considered a competent mechanical draftsman and received from $17 to $27 per week during the next seven years, and in the tenth year after leaving school became a mechanical designer at $30 per week. Among those who had learned a trade before attending school was a machinist who,

upon graduating, was qualified as a mechanical draftsman, in which occupation he worked for four years, receiving $18, $19, $21, and $23 per week, respectively. He next filled the position of foreman in a machine shop for one year at $25 per week, and was then promoted to chief draftsman at $30 per week. After working in this position for five years he resigned and started in business for himself, and is now a successful manufacturer. The foregoing is a fair illustration of the progress made by the other graduates. No other class of graduates is more enthusiastic over the benefits accruing from trade or technical education. They are all strongly in favor of such education for boys who desire to learn a trade, but agree with the general sentiment of those reporting under other occupations that trade or technical training alone will not make a finished workman. A combination of shop and school training is deemed necessary to obtain the best results. School training gives a boy a good theoretical foundation to build upon and enables him to make better progress when he engages in the actual work of his trade and to ultimately attain a higher degree of proficiency than the merely shop-trained workman.

ATTITUDE OF LABOR UNIONS.

BARBERS.

From the first establishment of schools for barbers the unions and the craft generally have been strongly opposed to them. Various reasons are assigned for this opposition, the main one being that the work of the schools is not thorough and the next in importance is that such schools increased unduly the number of barbers. The fight against the schools by the unions has been waged with unrelenting bitterness. In some localities the unions carried their grievances into the courts, and in more than one State the legislature was prevailed upon to regulate the practice of the trade by requiring licenses issued upon examination made by a competent board of examiners. But this did not greatly disturb the schools, and they continue to thrive.

The opponents of these schools claim that the time required by the schools to graduate their students is entirely too short and that the practical instruction is altogether too meager. Notwithstanding this pronounced opposition the opinion is quite prevalent that schools properly conducted and offering a course of training of two or three years would be of benefit to the trade. The unions are beginning to realize that the schools have secured a foothold and there has been some attempt to elevate and improve them.

In Douglas County, Nebr., the unions have indorsed the American Barber College in Omaha,[a] and the first experiment is now being made of craft control of the schools. The Trans-Mississippi Barber,

[a] See pp. 168–170.

the official paper of the State Barbers' Protective Association of Nebraska, in its issue of March, 1900, advocated craft control of the schools. The editor states that after several years of careful study and hard labor he became thoroughly convinced that it is impossible to control such institutions by law, as had been so fondly hoped by the craft, and that the solution of the question lies in craft control. He says that the old apprenticeship system has been outlived and that schools offering a shorter and better course of training will attract a superior class of men into the trade. The schools as they have existed are pronounced rank humbugs, but their graduates turned out in six weeks are better equipped for their work than are large numbers of barbers who neither went to a school nor served a regular apprenticeship.

The unions limit the number of apprentices to one to each three barbers in a shop, and fix the term of apprenticeship at three years. Except in Douglas County, Nebr., no union was found which recognizes the work done in the schools, and no matter how long the apprentice has been in a school it counts for nothing with the unions. In this instance the graduates from the indorsed school are recognized as regular journeymen barbers when they have obtained a State license.

Nearly all of the union officials answering the inquiries of the Department state that they would patronize schools if they were of a high order and would thoroughly teach the scientific side of the trade.

BREWERS.

While brewers' unions have not contributed pecuniary aid to brewing schools, they do give them moral support and are friendly to them. Union officials uniformly look upon such schools as a valuable adjunct to the industry.

The unions limit the number of apprentices, the ratio varying from one apprentice to fifteen journeymen to one to fifty, according to the size of the brewery, the smaller ratio being applied to large establishments. The term of apprenticeship is two years without regard to school attendance.

The union officials state that they would patronize brewing schools, but they would have their sons serve terms of apprenticeship first. They say it is necessary to work in a brewery to learn many minor things which schools have not the facilities to teach. But the schools give indispensable training which would require an unreasonably long time to get in a brewery; in fact thorough technical training can not be had in the brewery at all. It is desirable that a boy should reach the highest position in his trade in the shortest possible time, and the schools are the best if not the only places where he can acquire the requisite knowledge.

BRICKLAYERS.

It is generally conceded that any school where a workingman can receive instruction which will help him in his trade is a benefit. But in some localities, especially in Massachusetts and New York, it is held that a trade school to be really valuable should be open only to those who are at work at the trade. In Massachusetts it is thought that it would be a good plan in all trades to make the term of apprenticeship four years with four months in each year to be devoted to attendance in a trade school. Another and more convenient course to pursue would be to have the trade instruction given in continuation (night) schools, so that the workman could attend them while still working at his trade. This latter plan is followed in most of the schools which give instruction in trade work.

None of the unions has given pecuniary aid to the schools, though in one or two places they have the moral support of the local unions.

In the "Working rules and apprenticeship system of the Master Builders' Association and the Bricklayers' Union, No. 3, of Boston, Mass.," the following statement is found:

Recognizing the fact that special instruction in the fundamental features of the bricklaying trade (which instruction shall comprehend education of both mind and hands, so that the individual shall gain a proper knowledge of quantity and strength of materials and the science of construction) is of as much importance as special instruction in other trades or professions, and, realizing that the chances of an apprentice to get as much instruction as he is entitled to, while at work on buildings, is necessarily limited, the parties to these rules agree that they will join in an effort to establish an institution in this city (Boston) where all the trades will be systematically taught; that when such school is established they will unite in the oversight and care of the same and will modify these rules so that a reasonable deduction shall be made from the term of an apprentice (not less than three years as fixed at present) by virtue of the advantage gained through instruction in said school.

Such a school as the one mentioned in the above was started in Boston by the Massachusetts Charitable Mechanic Association in October, 1900. It teaches the trades of bricklaying, carpentry, and plumbing only, though it is intended to add the teaching of other trades from time to time.[a]

Generally speaking, neither the unions nor the individual members thereof would be opposed to trade schools which are open only to apprentices or workmen, but schools which take in boys outside the trades and attempt to make mechanics of them are strongly opposed. Such schools help to create an abnormal supply of embryo workmen, and this tends to make the position of the skilled mechanic less secure and has a depressing effect upon wages. An apprenticeship of four

[a] For particulars of this school, see pp. 65, 66.

years is usually required, and the unions limit the number of apprentices employed in the trade. In one place the local union deducts one year from the regular period of apprenticeship in the case of trade-school graduates.

As to the question of sending their boys to trade schools, the consensus of opinion of the labor-union men is generally opposed to boys learning trades if possible to prevent it, but if no other opportunities offer, to send boys to such schools as are run in connection with actual work at the trade. They believe that a trade can be mastered thoroughly in all its details only by a proper mixing of school training with work at a trade at the same time. One or the other alone will not accomplish the purpose; at least school training alone never will, and shop training alone will not do it for the majority, nor for the exceptional few within a reasonable time. Under present conditions a competent bricklayer is never made by working at the trade alone, and only a combination of the two kinds of training will enable him to rise higher than his trade in the economic scale.

BRIDGE BUILDERS AND STRUCTURAL IRON WORKERS.

The president of a union in one of the North Central States makes the following statement:

This is a trade which, from its very nature, can not be taught in schools, though some parts of it might be taught to advantage. The matter of trade education has never been considered by the unions, but individual members have expressed a desire to see some attempt made in this direction. Apprentices are required to serve two years, and the number employed is limited, according to the class of work. I would send my son to a trade or technical school, because I believe that thorough education in any occupation makes a better workman and a better citizen. As a rule, our best workmen are those who are best educated, and if they had been educated in the special direction of their trade they would be still better mechanics. While it is not possible for a man to do good work or to supervise construction without having practical experience, yet to follow and understand the plans of an engineer he needs technical training. He should at least possess a knowledge of industrial drawing. School training would certainly enable a boy to rise more rapidly in his trade and would increase his chances for obtaining better and steadier employment.

CARPENTERS AND JOINERS.

The opinion is expressed among trade union officials that industrial, technical, and continuation (night) schools, and also schools of design, are all very valuable to the workingman provided he is able to take the instruction they offer, but the trade school—the school which attempts to teach trades in their entirety—is of little, if any, value. It is claimed that the trade school does not and can not teach a trade, and that it is impossible for a graduate to be a competent workman as

a result of his school education alone, actual work at the trade being an absolute necessity for the making of the skilled mechanic. Another reason given why the trade school is not a benefit is that employers no longer desire the thoroughly-trained all-round man, but want only the specialist. They have men in the trade who do nothing but hang doors, others who do nothing but stick molding, etc., and it is men of this kind, who can do but one operation well and who do it quickly, that the employer really wants. A course in a trade school may, perhaps, at its best, teach a young man to perform all the operations of his trade fairly well, but it is thought to be impossible for him to compete with the specialist in any one of them, since he is not, and can not be, under present conditions, a competent workman. A technical school, however, which does more than teach the elements of the trade, which gives the pupil the science of it, the skill in drawing and designing and an insight into the underlying theory of the trade, may, and probably will, produce a high-grade mechanic, the man who may become a foreman, a superintendent, or the head of a department in some great industry; but the trade school at its best, it is claimed, can not turn out a man who can compete with the specialist in any branch of his trade. The opinion was expressed that a boy desiring to learn a trade should not, therefore, be sent to the so-called trade school.

Generally speaking, the unions have given neither moral nor pecuniary aid to trade schools, but, on the contrary, have opposed them, and the individual members are usually averse to the idea of such schools.

In some places an apprenticeship of three years is required, but as a rule a man who has worked three years at the trade, whether as an apprentice or otherwise, is eligible to membership in the unions. In one place the union limits the number of apprentices on the basis of one to every ten journeymen.

CIGAR MAKERS.

Trade schools might be valuable to the workingmen who are engaged in mechanical establishments but not to cigar makers. The unions and the individual members are opposed to so-called trade schools which exist in this industry on the ground that they foster child labor and work injury to the trade.

Schools have been started in this industry, and small sums of money exacted from boys and girls on the pretense of teaching them the trade, but after a few weeks' instruction they have been turned adrift to make room for others. These boys and girls can not hold a job in a reputable shop, and consequently they shift from one place to another and are compelled to accept whatever wages they can get. When there is any labor disturbance they naturally drift into the shops

and become a menace to the union workmen. It is said that these schools are favored by the manufacturers, as they help to flood the labor market with cheap labor and are, therefore, an effective means for reducing wages. The unions require an apprenticeship of three years and the number of apprentices is limited to one to every five journeymen.

ELECTRICAL WORKERS.

Both the unions and the individual members are opposed to trade schools on the ground that they are not practical. It is claimed that they turn out a cheap class of workmen who accept employment regardless of the wages paid and thereby make trouble for the regular journeymen.

The unions require an apprenticeship of two years, but do not limit the number of apprentices employed in the trade. They claim that trade schools may be useful to give a boy a knowledge of the use of tools and the various materials he would have to work with, but that they can not teach him a trade. This can be accomplished only by working at practical everyday work as it comes along.

ELEVATOR ERECTORS.

A representative union man in this trade states that schools which teach mechanical trades are valuable to the workingman if he will attend them. The union is not opposed to trade or technical schools. An apprenticeship of four years is required and the number of apprentices employed in the trade is limited according to the requirements of the business. He would send a boy to a trade school for the reason that the technical and scientific knowledge there obtained would be a great help to him in the performance of his work. In this trade especially a knowledge of hydraulic, mechanical, and electrical appliances is necessary, and schools which give instruction along these lines are a benefit to the mechanics.

GARMENT WORKERS.

The following statement is furnished by a prominent official of the United Garment Workers of America:

Trade and technical schools are beneficial in so far as they teach journeymen the higher branches of a trade which would have the effect of stimulating craft pride and a desire for larger remuneration. In view of the changes which are continually taking place in the methods of production, a more general knowedge of mechanics would increase the workers' independence by making it possible for them to change from one branch of a particular trade to another when required in an emergency. In other words, technical training would enable the worker better to adjust himself to changing circumstances. But as there seems to be a superabundance of apprentices in every trade which guarantees a fair wage, and as this is a great obstacle which unions have to contend with in regulating conditions, it would appear

that trade schools would tend still further to depress wages and add to the number of unemployed by thrusting into the ranks large numbers of boys and young men in addition to those which are added through the natural channels.

The national union has never given such schools any moral or pecuniary aid because in the tailoring and cutting branches the supply of apprentices is more than the interests of the trade demand. In the tailoring branch the ranks of the tailors are continually reenforced by immigrants who quickly learn the minor parts of the trade in the thousands of sweat shops which are conducted by petty contractors who themselves have only been here a short while. Besides there are a number of private cutting schools which teach pattern drafting.

Local unions of cutters require an apprenticeship of three years for a green hand, which period is reduced to one year in the case of a journeyman tailor. The number of apprentices is limited to one to every ten journeymen or majority fraction thereof. Owing to the overcrowded condition of the labor market, I would suggest that young men be trained in the agricultural pursuits, which offer an ever-widening field. A balance must be maintained between the fundamental industry of farming and the mechanical trades. The tendency, owing to the attractiveness of the cities, is toward a still further increase in the number engaging in the trades, thus adding to the distress. If schools were established in the rural districts to teach young men the science of farming, I believe great good would be accomplished.

GRANITE CUTTERS.

A leading official of the Granite Cutters' National Union in Massachusetts is of the opinion that schools which give trade instruction are valuable to the workingman, provided their teaching is confined to workingmen only. The unions limit the number of apprentices employed in the trade, and an apprenticeship of three years is required. Trade or technical education of any kind will not help a young man to become a journeyman in a shorter time, but it will add to his general intelligence and in the end will enable him to rise higher in the industrial scale. The unions have never given any aid to trade schools, but they are not opposed to them when their courses are open only to those who are actually employed in trade work. No boy should be sent to such a school to learn a trade, but only for the purpose of obtaining a theoretical and general knowledge, for the school alone can never make a mechanic. Practical experience in the trade is necessary.

An official in another section practically coincides with the foregoing, except that he believes that the schools should be open to all who desire to obtain instruction.

MACHINISTS.

In this trade the consensus of opinion seems to be that trade or technical schools are valuable to workingmen when conducted for the purpose of educating and training young men to become skilled in a

trade, but when used as a means for providing a class of cheap help to supplant union mechanics in times of labor troubles they are a detriment.

Except in one or two places in the North Central States, the unions have given but little attention to trade or technical schools, though the officials and representative members generally are in favor of them when not conflicting with the interests of journeymen. In two places in the North Central States the unions are hostile to schools which undertake trade education, on the ground that they have a tendency to overcrowd the trades, and that they do not turn out practical workmen. In one of these, however, it is said that the hostility is dying out as the rank and file of the members come to realize that the dominant idea of "everyone for himself" makes it important that every mechanic should acquire all the knowledge possible regarding the theoretical and scientific principles of his trade. As the president of one union says: "Any course of training which will give a boy or young man a knowledge that will assist him in earning an honest living and place him in a better position to advance in the industrial scale is certainly a benefit, and schools that do this ought to be encouraged."

The unions limit the number of apprentices to one to every five journeymen, and the period of apprenticeship is fixed at four years.

PAINTERS AND DECORATORS.

In one place the unions are opposed to trade schools on the ground that they help to flood the labor market with an inferior class of workmen who work for low wages. This has a bad effect upon the standard of wages and makes considerable trouble for the unions. The unions in this place require an apprenticeship of five years and limit the number of apprentices to one to every five journeymen, and not more than two to each shop. It is said that a boy will make better progress by starting as an apprentice in the trade. In this way he will learn all the theory necessary and at the same time have the benefit of all kinds of practical work, such as he may expect to meet after he becomes a journeyman.

In another locality trade schools are thought to be a benefit to workingmen as they afford them an opportunity to acquire a good theoretical knowledge of the trade. While an apprenticeship of four years is required they make no attempt to limit the number of apprentices.

PATTERN MAKERS.

Trade and technical schools are valuable to workingmen in so far as they afford instruction which can not be had in the workshop. The unions have given neither moral nor pecuniary support to such schools, nor have they taken any decided action regarding them, but

the officials and representative members who were interviewed are in favor of them where they give thorough instruction in the theory and science of the trades. It is thought that some trade schools are little better than manual training schools, and consequently are of little practical benefit to the students. No school can turn out a skilled mechanic, but the technical knowledge, and more particularly the instruction in industrial drawing, which can be acquired in some schools is an advantage to any boy who desires to take up mechanical work. An apprenticeship of four years is required, and wherever possible the number of apprentices is limited by the unions.

PLASTERERS.

In some sections of the North Atlantic States trade or technical schools are considered to be of no particular value to the workingmen in this trade. They receive neither moral nor pecuniary support from the unions, and while no official action has been taken regarding such schools, the individual members are generally opposed to them on the ground that they are not practical. It is said that they teach the use of tools very well and give the pupils some idea of plain work, but they do not teach them the entire trade. This, it is said, requires many years' experience in actual work. An apprenticeship of four years is required, and the number of apprentices is limited to three to each shop.

An official of the local union in one of the South Central States is of the opinion that all trade and technical schools are a benefit to workingmen provided they are able to attend them. He states that his union is favorably disposed toward such schools, and that he would send his son to a trade school if he desired to prepare him for a trade.

PLUMBERS, GASFITTERS, AND STEAMFITTERS.

The labor unions and their representative members are strongly opposed to trade-school education as applied to these trades, on the ground that too much time is devoted to theoretical work and too little to that which is practical. It is said that the employers prefer trade-school graduates because they will work cheaply. This is a source of trouble to the unions. An apprenticeship of five years is required, and in one locality the steamfitters' union endeavors to limit the number of apprentices. It is stated that in the schools the students are rushed through the simpler parts, and after completing the course they think that they are proficient, but when practical work is taken up outside they learn their mistake. Trade schools can give a boy good theoretical training, but the trade itself can be learned much better by starting on practical work in a shop.

PRINTERS.

The trade union representatives responding to the inquiries of the Department consider that industrial, technical, and continuation (night) schools and schools of design have their functions and are valuable, but trade schools are of no practical value to the workingman. No boy should be sent to a trade school, at any rate not for the purpose of learning a trade, as for that purpose he could do much better in the shop. The opportunities for learning the printing trade are ample, and knowledge gained in regular office and shop work is much more satisfactory and practical than knowledge gained in a school. It is still possible for a boy to become a good printer by an education gained in the printing office alone. It is only in the larger offices that the tendency to specialization in the trade is marked.

The unions have given no moral or pecuniary aid to trade schools, though in some parts of the North Atlantic States it is thought that night schools, with a course arranged to supplement office work, would probably receive their moral support if the question should be raised. The unions and the individual members generally are opposed to trade schools, and some unions in Massachusetts have openly antagonized and condemned the idea of establishing such schools. It is contended that the trade school is usually a commercial enterprise instituted as a money-making scheme, professing to teach what it does not teach, a trade. Such schools have a tendency to cause an abnormal influx of young men into a trade where there is no room for them. The demand by legitimate employers for young people to learn any specified trade is quite sufficient to keep up the standard of recruits in that special industry. An artificial stimulus such as a trade school disturbs the working of the natural industrial law, has a tendency to create a glut in the labor market, intensifies competition among workingmen, and has a depressing effect upon the standard of wages.

The printers' unions require a period of apprenticeship of from four to five years and limit the number of apprentices employed in the trade. They insist that trade-school graduates shall serve an apprenticeship of the same length as others in spite of their school education.

SHEET METAL WORKERS.

Trade and technical schools are valuable to workingmen because they give a theoretical training that can not be gained otherwise. The unions are not opposed to the schools or the graduates. On the contrary, the graduates are encouraged to join the unions. In this way the unions are better able to control the trade and the men who work in it.

An apprenticeship of four years is required and the number of apprentices is limited to one to every five journeymen or majority

fraction thereof, but not more than four in any one shop. A good education is a benefit to any boy no matter what trade he may follow. While trade schools can not teach a boy a trade, yet the theoretical and technical knowledge that young men obtain in such schools is a great benefit to them when they engage in actual trade work.

TEXTILE WORKERS.

The following statement is furnished by a prominent official of one of the textile workers' unions in Massachusetts:

Trade and technical schools, schools of design, and all schools, however designated, where trade or technical education can be obtained, are valuable to the workingman. All boys desiring to learn a trade or industrial occupation should attend such schools if possible, because the knowledge they acquire there gives them a better chance to rise in the industrial scale, and enables them to look forward with good reason to a future of some success and comfort, and not entirely devoted to grinding labor with only a pittance as reward. While the exceptional man may, and sometimes does, rise to high positions by his work in the mill alone, the average man can never do so in the textile industries without the aid of the special school education.

The textile labor unions have given moral aid only to trade schools. They recommend that their members attend them, and as unions they are inclined to favor such schools. Many of the individual members have been, and some now are, opposed to such schools, especially to the textile schools, because they believe that they are designed to help the rich rather than the poor, to provide technical and high-class education for young men of means who intend to go into manufacturing instead of providing opportunity for workmen to obtain a better education in their trades. This is not generally true, for while some of these schools furnish good opportunities for young men of means to obtain a higher education in technical and industrial lines, they also furnish the workingman, especially in the night classes, thorough and complete courses of training in the trades.

Granting, however, that there is a basis for the criticism made, and that these schools do tend to provide for the educational wants of the sons of manufacturers, etc., rather than for the mill operatives, they would still be of assistance to the textile workers, because if we can obtain in this country, as owners and operators of mills, men who are well educated in the theory and science of textile manufacturing, we shall see constant progress made in the art, a greater variety of goods and goods of higher grades will be made, the processes of manufacturing will be improved, and the cost of the same cheapened as a result of superior technical knowledge. All this will be better for the workmen, as it will create a steady demand for their services and tend to bring them an increase of earnings.

Personal experience in the mills of this country and of England has shown that the mills in the New England States are, generally speaking, making too great a quantity of low grade goods, and are already encountering competition in this line which they have difficulty in overcoming, and which they will soon be unable to meet. This condition is unnecessary. Our mills can make as good cloth as can be made in

any part of the world if their owners and operators will only pursue the right course, and the higher technical education given in our textile schools will tend greatly to aid in the attainment of the end desired.

The textile unions of this locality do not limit the number of apprentices employed in the industry. All they ask of anyone who enters a mill is that he join and support the union and aid it in its struggles for justice and right. These unions do not require a period of apprenticeship in the textile trades, though it would be better for the industries if they did.

CHAPTER III.

TRADE AND TECHNICAL EDUCATION IN AUSTRIA.

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INTRODUCTION.

The history of industrial education in Austria properly dates from the middle of the eighteenth century, when the policy was adopted by the State of calling in from foreign lands experts in particular branches of industry to give instruction to workmen in those trades. Thus, in 1749, Dutch masters were sent into Bohemia to give instruction in the making of cloth; in 1750 Italian artisans were called upon for the same purpose. For cloth dyeing a dyer was called from France. In 1755 glass workers from Ferrara, Italy, were sent into Bohemia. During the years 1766 to 1770 sizers were brought from Switzerland and dyers from Silesia.

The first effort to establish a regular school for practical instruction was made in 1751. When the Trades and Factories Bureau of Moravia was created in that year, it was instructed to see "that a mechanical training school in the mother tongue, so necessary for the public good," be established as soon as possible. For reasons that are unnecessary to dwell upon here, this idea was never carried out. In 1758, however, a real beginning in the provision for industrial education was made by the founding at Vienna of a manufacturers' drawing school (*Manufakturzeichenschule*).

The next step was made in 1770 by the creation, likewise at Vienna, of a commercial academy or high school (*Realhandelsakademie*). At this time the distinction between commercial and industrial education was not made. In fact most of the early efforts partook rather of commercial than industrial education, as industry was then almost wholly in the hands of the small artisans working under the guild system. It was evident that so long as industrial activity consisted only in the practice of certain handicraft trades, and was independent of any principle based upon scientific inquiries, that there was little room for industrial schools as now organized. The chief significance of the founding of the commercial academy and other early institutions, from the standpoint of the present reports, is the evidence that it gives of the recognition of the desirability of giving practical instruction in matters relating to business through special schools. The Vienna

commercial academy did not meet with great success during the earlier years of its history. Trade and industry were so hampered by restrictions and monopolies that there was little opportunity or incentive for improved workmanship or processes. These restrictions, however, were gradually removed.

Immediately after the creation of the commercial academy, or during the years 1771 to 1774, the Government applied itself to the creation of schools that would afford the same opportunities for instruction to manufacturers and handicraftsmen that the academy did to merchants. A comprehensive system of normal, central, and industrial schools (*Normal-, Haupt- und Industrieschulen*) was founded in which industrial training received considerable recognition. This combination of the general with industrial education made special progress in Bohemia. In 1787 there were 100 such industrial schools in that country, and in 1790 this number had increased to 232.

After something of a setback to the movement during the closing years of the eighteenth century, owing to the reactionary commercial policy of the country, a new movement started in 1804. This took the form of the creation of modern, practical high schools (*Real- und Bürgerschulen*), the object of which was to educate pupils who expected to enter into practical business operations. The courses of instruction comprised, among other studies, building, drawing, bookkeeping, commercial practice, and special subjects according to the industries of the localities in which the schools were located. The first school of this character was opened at Reichenberg, a private donation of 24,000 florins being secured for that purpose. In 1806 another school was founded at Prague. From this date efforts in behalf of industrial education began to be manifest in various directions. In 1808 a "*Direktion über das Kunstfach der Volksschulen*" was created to have supervision over drawing in the schools of both Vienna and the provinces. In 1811 a modern high school (*Realschule*) was instituted at Brünn, with a three-years' course modeled after the one at Vienna. In 1812 an art and industrial institute for women's work (*Kunst- und Industrieanstalt für weibliche Arbeiten*) was created at Vienna, and supported by private donations. In 1815 was opened at Vienna the important Polytechnic Institute, the first of its kind in Austria, and the first but one in Europe, the Paris École Polytechnique having been opened in 1795.

The opening of the Vienna Polytechnic Institute marked a great advance in industrial education. It furnished, as it were, a head to the system to be subsequently evolved. It was organized in two departments—the mathematical-physical and the commercial. To it was annexed the commercial academy, the founding of which has been mentioned, as a preparatory course. This institution permitted graduates of the *Realschulen* to continue their studies in the higher tech-

nical branches. The number of these schools continued to increase, additional ones being created at Brody in 1815, at Trieste and Lemberg in 1817, at Rakonitz in 1834, and at Reichenberg in 1837. The Prague school, which may be taken as a type, was organized in three sections—the first for the training of artisans, merchants, manufacturers, dyers, watchmakers, mechanics, and instrument makers; the second for agriculturists; the third for those intending to enter certain Government positions.

The institutions for industrial education in Austria in 1840, apart from the ordinary schools in which some attention was paid to industrial matters, may be recapitulated as follows: One polytechnic institute, Vienna; 2 provincial technical schools, Prague and Grätz; 1 commercial academy, Lemberg; 7 modern high schools, Vienna, Prague, Brünn, Trieste, Brody, Rakonitz, and Reichenberg; 4 provincial drawing schools, Prague, Olmütz, Lemberg, and Grätz; 1 manufacturers' drawing school, Vienna.

These institutions were designed to meet the new needs of industry consequent upon the increasing application of science to industry and of production upon a large scale. In the meantime the small handicraft trades were not only feeling the competition of the factories, but were without adequate schools for training the persons employed in them. To determine the best means of aiding these trades, the Government made a careful investigation of conditions. In consequence of this inquiry, there was passed the important imperial resolution of 1851, the purpose of which was to outline an elaborate scheme for the reorganization of the school system of the country so that the instruction given should be more practical in character, and adequate provision be made for training in particular branches of industry.

According to this program the public school (*Volksschule*) was made the foundation for the entire educational structure. On this as a basis were to be erected schools having more special ends in view. In particular was especial attention to be paid to the interests of manufacturers and handicraftsmen. This task was assigned to the modern high schools (*Realschulen*). The purpose of these schools was to be twofold—preparation for industrial work and preparation for the higher technical institutions. There were furthermore to be created Sunday continuation schools and schools for giving instruction in special branches for handicraftsmen. Through them apprentices and journeymen would be able to educate themselves without interruption to their work.

Although the intentions of the Government were good, political disturbances and other occurrences prevented energetic action being taken for some years. The creation of continuation courses for artisans proceeded but slowly during the fifties and sixties. Such as were established were usually in connection with the *Realschulen*, this being done at Brünn in 1852, Innspruck in 1856, Prague

and Salzburg in 1858, Laybach in 1860, Grätz in 1864, etc. During the years 1858 to 1867 six such schools were created in connection with the Vienna high schools through the efforts of the board of trade and industry of the city. In the latter year these schools were attended by a total of 1,440 pupils.

Technical education was also being developed in other directions. Special schools for particular trades were created by communal authorities, private corporations, and manufacturers. Weaving schools were established at Reichenberg in 1852 and at Brünn in 1860; a drawing and modeling school for the glass industry at Stein Schönau in 1856, and a school for the building trades at Vienna in 1865.

The only large industrial school established by the State during this period was the Imperial Industrial Drawing School at Vienna. The origin of this school is really found in a course which was created in 1848 in connection with the *Polytechnikum*. It was made independent of this institution in 1865 and in 1870 was converted into a school for the building and machinery trades. Its importance historically lies in the fact that it was the first purely technical school of a secondary grade to be created by the central Government.

Notwithstanding the creation of the schools that have been mentioned, it can not be said that rapid progress was made in the development of the scheme that had been outlined in 1851. The only direction in which substantial advance was made was in the creation of *Realschulen* of various grades. Thus, at the end of 1853 there were in operation the following schools of this class: Lower *Realschulen* organized in connection with higher institution—16 in the province of Lower Austria, 30 in Bohemia, 13 in Moravia, 4 in Silesia, 10 in Tyrol, 4 in Styria, 1 in Carinthia, 2 in Küstenland, 11 in Galicia, 1 in Bukowina, 4 in Dalmatia, and 3 on the military frontier; separate lower *Realschulen*—1 each in the cities of Salzburg, Laybach, Cracow, Innspruck, Klagenfurth, Troppau, Budweis, Leitmeritz, and Brody; upper and complete *Realschulen*—2 at Vienna, 2 at Prague, and 1 each at Lintz, Brünn, Grätz, Lemberg, Cracow, Reichenberg, Rakonitz, and Elbogen; higher *Realschulen* or technical institutes—1 each at Vienna, Brünn, Grätz, Lemberg, Prague, Trieste, Cracow, and Pesth.

For a decade and a half these schools served the double purpose of preparing pupils for the higher technical schools, the *Polytechnikum*, and the State schools of forestry and mining that had been created, and of giving instruction preparing in a general way for industrial and commercial pursuits. This arrangement, however, was far from satisfactory. In attempting to do two things, they did neither well. In 1867, accordingly, it was decided to transform them entirely. This was done by the substitution in their programmes of humanistic for scientific and technical studies. Thus the very purpose for which the *Realschulen* were originally created—that of preparing students for

active industrial work was taken from them and they became primarily institutes preparing students for the higher technical or engineering schools. They then stood in the same relation to these latter schools that the gymnasium did to the universities. This reorganization took effect in 1868. The result was that, while Austria had, through these schools, built up an excellent system for the giving of scientific instruction, education for practical industrial work was neglected.

The reorganization of the *Realschulen* served the important purpose of bringing out clearly the necessity for special schools for training students in practical industrial operations. With the abandonment of the *Realschulen* as institutions for trade education, greater attention was paid to the other classes of schools, the creation of which has been noted. The continuation schools, which were known under the designation of industrial schools (*Gewerbeschulen*), continued to develop. They were intended for apprentices and journeymen who were occupied during the day, to whom they gave such opportunities for a general education as would enable them more intelligently to carry on their work, without, however, training them for any particular trade. Their purpose thus was partly to supplement the common school education, which was somewhat deficient, and partly to give some knowledge of the sciences as far as they found practical application in ordinary industrial work. Several of these schools had courses in drawing relating to particular trades.

In contrast with these continuation schools were the trade schools proper, which were gradually becoming more numerous in the Empire. At this date, 1867, there were weaving schools at Aussegg, Brünn, Bielitz, and Rumburg; a passementerie school at Vienna; a lace-making school at Rietz, Tyrol; a straw-plaiting school at Hochstadt, Bohemia; a drawing and modeling school at Stein Schönau; a building-trade school (Fried Märtens) at Vienna; a school for mechanical work at Klagenfurth; wood-carving schools at Hallein and Imst; schools for watch making, wood turning, and optical work at Vienna; a school for dyeing and print work, one for xylography, one for embroidery, and a machinists' school at Neustadt; a school for shoemaking at Grätz, and a school for porcelain work at Elbogen, besides others of less importance.

In the field of industrial art instruction there was at this time but one school, that created in 1862 in connection with the upper *Realschule* at Innspruck, for giving instruction in modeling, carving, perspective, and painting. The central Government, however, had created an institution that was destined soon after to play a very important part in the development of artistic workmanship. This was the Museum of Art and Industry, at Vienna, founded in 1863. This institution was created for the purpose of elevating and improving

artistic taste and work by direct instruction, as well as by the accumulation of artistic and industrial products for inspection by producers and consumers. By means of workshops for the making of plaster casts, photographs, etc., a large number of schools, both ordinary and industrial, were supplied with patterns and models. By the publication of a periodical—*Mittheilungen des Österreichischen Museums*—information was further disseminated. The same purpose was also accomplished by the courses of lectures given under its auspices. These means of activity, however, but partially accomplished the object of the museum. To complete its work it founded in 1868, as a branch of its organization, an industrial art school. In 1872 a course for the training of drawing teachers was added. In 1876 a far-reaching reform was made in the organization of the school by the division of its work into two sections—one devoted to general instruction and the other to technical trade instruction. Later on workshops for chasing and similar trades, for wood carving, for ceramic decoration and enamel work, for lace pattern making, and for wood scroll work were added. A chemical technical experiment station was annexed to the museum in 1876.

A circumstance which greatly retarded the development of industrial education during these years was that the Government had not as yet evolved any comprehensive plan for such instruction nor decided upon the authorities that should be responsible for its carrying out. Prior to 1861 authority in regard to educational matters was vested in the ministry of education. In that year was created a ministry of commerce, and as one of its duties was stated to be "cooperation in the creation and regulation of *Realschulen*, industrial and nautical schools, and polytechnic institutions," the new department claimed and secured coordinate influences in the direction of industrial education.

In 1872 the Imperial Council (*Reichsrath*) placed to the credit of each of these departments a yearly sum of 80,000 florins, to be applied to the development of industrial education. In order to prevent a conflict of authority a division of industrial schools was made between the two ministries. To the ministry of commerce were assigned schools teaching a distinct trade or branch of work and weaving schools, in so far as they were not integral parts of other institutions, for general instruction. To the ministry of education were given all general science or industrial schools, continuation schools, or those supplementing the work of the ordinary public schools, and intermediate industrial schools (*gewerbliche Mittelschulen*), such as those preparing building contractors, foremen, machinists, etc. Under this class were included all schools teaching a number of different trades. The result of this division of the field has been the development of two systems of industrial schools. To a considerable extent a rivalry existed between the two ministries, and it is

reported that in spite of the loss of efficiency coming from division, this rivalry resulted in more action being taken than would otherwise have been the case.

The chief care of the ministry of commerce was the development of the special trade schools (*Fachschulen*). The guiding principle here adopted was that the schools should give as practical instruction as possible, and that the programme of each school should correspond to the industrial requirements of the locality in which it was located. In the selection of localities for the creation of trade schools the choice was made of those in which there existed a trade or industry susceptible of being aided by the provision of trade instruction, or in which conditions were favorable for the development of a new or the resuscitation of an old industry. The expenses of creating and supporting schools fell primarily upon the local authorities, the ministry of commerce cooperating through the grant of yearly subsidies. The latter also assumed the task of training or supplying proper teachers.

The ministry of commerce especially strove to have created in each province one or more schools that should be model institutions (*Musterstätten*), in order that private and local authorities might have a guide and stimulus in their action. The ministry also made extensive investigations of industrial education in the Empire and in foreign countries. As the result of these efforts the ministry of commerce had created, or cooperated in creating, up to 1881, 75 or more special trade schools, namely, 5 technical schools for lace work, 1 for fancy embroidery, 26 for weaving, 25 for wood and stone work, 6 for glass and ceramic work, 1 for toy making, 1 for silver filagree work, 1 for firearms making, 1 for artistic locksmithing, 3 for iron and steel working, 2 for musicians, 1 for watch and clock making, 1 for shoemaking, and 1 for painting.

During this same period the ministry of education was building up schools of a somewhat different character. Higher technical education, as has been said, had already received a considerable development, but attention was principally concentrated upon the creation of intermediate industrial schools (*gewerbliche Mittelschulen*). The first step in this direction was taken by the conversion of the imperial industrial drawing school at Vienna into a secondary industrial school for the building and machinery trades (*Gewerbeschule für das Bau- und Maschinenfach*).

In 1873 three new industrial art schools of intermediate grade were established at Brünn, Czernowitz, and Bielitz, and the necessary funds for their maintenance provided by items in the regular budget of the ministry. The ministry also about this time began to devote greater attention to the matter of training teachers, the securing of proper school furnishings and materials for instruction, and the development

of improved methods of teaching drawing. Particular care was bestowed upon the application of art to industrial work. The incentive to this came from the fine showing made by the French in art objects at the Vienna Exposition of 1873.

The year 1874 marked a turning point in the organization of these secondary industrial schools, since reforms were then inaugurated that have given to the modern system its present character. An official inquiry was instituted by the ministry of education in regard to industrial education in Austria and foreign countries. The report of this inquiry ([a]) recommended, among other things, that the industrial school system should seek to give instruction of a more specialized character, and that greater emphasis be placed on the practical features. Especially was it suggested that a limited number of large model industrial institutions (*grosse musterhaft ausgestattete Gewerbebildungsstätten*) be created at a few central points, so that they might serve as types for the organization of smaller schools.

As the result of these recommendations an imperial decree was issued October 11, 1875, providing for the institution of State industrial schools. The motive for the founding of these institutions was stated to be as follows: The rapid development of industrial technics; the great increase in industrial educational institutions in other countries; the prominence assumed by the national sciences in consequence of the increasing use of machinery; the ascendency of the system of large production over small production; the competition of countries which enjoyed a better developed system of industrial education; the complaint that Austrian manufacturers had to go abroad for technical experts of a medium grade, and that the Austrian must go to foreign institutions for such instruction.

These State institutions, which were duly created in the following year, were organized upon a thoroughly systematic basis. The existing secondary industrial schools were defectively constituted in respect to the requirements of admission and the classification of students. Students having received the most diverse preparation in other institutions were placed on the same basis, no distinction being made between those who had and those who had not had practical experience in a trade. This system of mixing the students in the same courses and classes was abolished, and two classes of students were created according to the previous training that they had had and their intended vocation. The schools themselves were divided into the two classes—those for foremen (*Werkmeisterschulen*) and higher industrial schools (*höhere Gewerbeschulen*). The plan then adopted remains practically unchanged at the present time, and is described in detail under the head of Schools for Important Groups of Trades.

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[a] Exposé über die Organisation des gewerblichen Unterrichts in Oesterreich.

Immediately on the definite formulation of this scheme, or in 1876, the ministry of education began the construction of schools after the pattern determined upon. Such schools (*Staatsgewerbeschulen*) were opened at Prague, Reichenberg, Salzburg, and Grätz. The school at Prague was for the building and machinery trades; that at Reichenberg for building, machinery, and chemical trades; and at Salzburg and Grätz for the building and ornamental trades. The Reichenberg school was to be regarded as both a higher industrial and a foremen's school, while the others belonged to the latter category only. To anticipate somewhat, it may be said that additional schools have since been created, so that on January 1, 1900, there were 18 State industrial schools, of which 9 were higher industrial schools with various branches and foremen's schools attached, and 9 foremen's schools only. Each of these schools also had annexed to it an industrial continuation school which was intended to serve as a model for independent institutions to be created later on.

These State industrial schools proved to be remarkably vigorous and successful institutions. By means of a single supervisory office and the employment of expert school inspectors the ministry of education was enabled to obtain an exact insight into the workings, conditions, shortcomings, and merits of these newly organized educational institutions. In this way the methods of instruction, the working materials, and the teaching personnel were subjected to constant improvement.

The ministry of education did not, however, limit its activities to this one direction. Among the other work during the decade—1870 to 1880—may be mentioned the attention paid to the development of industrial art, the endowment of the Austrian Museum of Art and Industry, the reforming of the industrial art school at Vienna, the continued improvement in the teaching of drawing in all the schools, the creation of special drawing and modeling schools, and the development of the continuation or Sunday and evening schools for working artisans. During this period was also created the Imperial-Royal Technological Industrial Museum, which was destined to serve as a central institution for the technical side of industry in the same manner as the existing Museum of Art and Industry did for the artistic side.

In 1881 a new era in the history of industrial education was inaugurated. It was then that the schools were welded into one logical system such as exists at the present day. Developments since that date have been merely in the way of carrying on the plans then formulated. Prior to 1881, as has been stated, industrial education was intrusted partly to the ministry of education and partly to the ministry of commerce. This division of authority became increasingly detrimental to progress as the importance of the work became greater. Until unity of administration was obtained, a harmonious system could

not be created. Accordingly in 1881 a law was passed which provided that "beginning with the year 1882 the appropriations for the entire industrial educational system should be placed to the credit of the ministry of education, and should be managed by it with the cooperation of the ministry of commerce."

Immediately after the passage of this law the ministry of education organized a system for the supervision and administration of industrial schools, which has continued with little or no change to the present day. This system, briefly, is as follows: The entire system of industrial education in Austria is under the jurisdiction of the ministry of education. The ministry of commerce has a consultative voice only. The provincial authorities act as intermediaries between the ministry of education and the particular schools, but all acts emanate from or are subject to the approval of the ministry of education. In the performance of the duties in the field of industrial education the ministry is assisted by two bodies—the central commission on industrial education and the central inspection service for industrial education. The function of the central commission is to cooperate in an advisory way with the ministry in respect to matters pertaining to (1) proposed laws relating to industrial education and inspection, (2) the creation, transformation, consolidation, or abolition of industrial educational institutions, and (3) the organization and management of exhibitions of industrial educational institutions. The central committee also has the initiative in all didactic and administrative matters so far as they relate to industrial education. The members are chosen for five years, one-half by the ministry of education and one-half by the ministry of commerce, and consist of persons whose accomplishments in the field of economics, technology, or art, or whose knowledge of industrial or educational matters in their districts are such as to make their advice of value. Membership is honorary, no compensation being given beyond a per diem for attendance upon meetings. In addition to the regular members, the ministry of commerce delegates a special representative who has a vote in the proceedings. A chief of division of the ministry of commerce presides over the meetings. The administrative reporters (*Referenten*) for industrial education in the ministry of education and the inspectors of industrial schools are also required to attend. The central committee may also in individual cases avail itself of the service of technical experts. The inspection service is organized according to the character of the institutions to be inspected, and not by territorial division. Provision is made for the appointment of 5 inspectors for technical, 3 inspectors for artistic, and 1 inspector for didactic-pedagogic affairs. The persons selected must be familiar with the actual needs of industry, as well as educational requirements.

The ministry of education publishes a periodical entitled "*Centralblatt für das gewerbliche Unterrichtswesen in Oesterreich*," the objects

of which are stated to be: To serve as a means of publishing all administrative resolutions and orders relating to industrial education; to give an extended circulation to the more important matters contained in the session reports of the central committee; to make known the principles regarding industrial education which are approved by the Government and by the central commission, and to explain, as far as circumstances permit, the reasons for official orders.

CLASSES OF INSTITUTIONS.

The result of this constant reorganization of the schools and the centralization of administration and supervision that has been described has been to give to Austria an exceptionally logical system of industrial schools, and has made it possible to refer each school to a distinct class of institutions. Thus the ministry of education classified the industrial schools into the following groups:

1. Central industrial educational institutions.
2. Schools for important groups of trades.
3. General handicraft schools.
4. Schools for particular trades.
5. Industrial continuation schools.
6. General drawing schools.

CENTRAL INDUSTRIAL EDUCATIONAL INSTITUTIONS.

The institutions under this general group (*gewerbliche Centralanstalten*) are, with one exception, the industrial art school of Prague, located in Vienna. Their function is the promotion of industrial education along particular lines or in some special way, and to serve as models for other schools in the Empire. A brief outline of each of these institutions will give an idea of their purpose and scope.

The Austrian Museum of Art and Industry (*Oesterreichisches Museum für Kunst und Industrie*) at Vienna comprises (1) a museum of plaster casts, textile fabrics, laces, embroidery, ceramic objects, glassware, jewelry, enamel, metal work, etc., which are intended to serve as patterns and models in the cultivation of industrial art; (2) a workshop for making plaster casts of original works of art, ornaments, etc., to be furnished to the industrial art, drawing, and other schools; and (3) an industrial art school founded in 1868, whose object is to supply skilled workers and teachers in the industrial arts. This school includes (1) a department for general work; (2) trade schools for architecture, painting, sculpture, and plastic art; (3) special workshops for chasing, wood carving, ceramics and enamel work, lace designing, etching, and artistic wood sawing and cutting; and (4) a chemical laboratory.

The Technological Industrial Museum (*Technologisches Gewerbe-Museum*) at Vienna was founded in 1879 and consists of a school for

various trades, a testing and experiment station, and an industrial museum. The educational work of the institution comprises departments for woodworking, for industrial chemistry, for the metal industry, and for electro-technics. This institution is described in detail on pages 455 to 475.

The Educational and Experiment Station for the Graphic Industries (*Graphische Lehr- und Versuchsanstalt*) was founded in Vienna in 1888. It is intended to encourage industrial art by teaching the most important methods of photographic reproduction and graphic work generally. It has four departments: (1) a school of photography and reproduction; (2) a school of printing and illustrating; (3) an experimental laboratory for photo chemistry; and (4) a museum for the graphic industries.

The Educational and Experiment Station for the Leather Industry (*Lehr-und Versuchsanstalt für Lederindustrie*) at Vienna was founded in 1874 for the purpose of making scientific researches in the leather industry and the application of the results in practice. Its work consists of experimental tests and processes used in the leather industry with reference to their practical value and utility, the making of tests requested by the authorities, associations, and individuals, and the giving of advice and instruction to manufacturers and others engaged in the leather industry. There is also a course for young persons in which theoretical and practical instruction is given.

The Trade School for Artistic Embroidery (*Fachschule für Kunststickerei*) at Vienna was founded in 1874, and gives instruction in all branches of embroidery work, special attention being directed toward the revival of ancient and the introduction of foreign styles of embroidery and the cultivation of an artistic taste in embroidery work. The school has a five years' course. Graduates of this school are eligible as teachers in embroidery schools. A special course in restoring carpets and tapestry was recently introduced.

The Central Lace-Making Course (*Central-Spitzencurs*) at Vienna was opened in 1879. It is intended to give a higher training to persons already skilled in lace making. The courses consist of lace sewing, lace making, and crocheting, and cover a period of ten months each.

The Model Trade School for Basket Making (*Musterwerkstätte für Korbflechterei*) at Vienna was founded in 1886. It is intended to educate teachers for the basket-making schools and also to prepare the patterns and models used in such institutions.

The Industrial Art School (*Kunstgewerbe-Schule*) at Prague, which was founded in 1888, is intended to educate persons for industrial art work and to train teachers for industrial art and drawing schools. It comprises a general art school, trade and special schools of various kinds, a school for women, and Sunday and evening schools in industrial art.

The following statement shows the attendance at these institutions at the beginning of the school term, 1899–1900:

AUSTRIAN MUSEUM FOR ART AND INDUSTRY, VIENNA.

	Pupils.
Department for general work	101
Trade school for architecture	25
Trade school for painting	70
Trade school for sculpture and plastic art	4
Workshop for chasing	11
Workshop for wood carving	10
Workshop for ceramics and enamel work	4
Workshop for lace designing	3
Workshop for artistic wood carving	3
Total	231

TECHNOLOGICAL INDUSTRIAL MUSEUM, VIENNA.

Department for woodworking	50
Department for industrial chemistry	54
Department for metal industry	152
Department for electro-technics	417
Evening and Sunday courses	415
Total	1,088

EDUCATIONAL AND EXPERIMENT STATION FOR THE GRAPHIC INDUSTRIES, VIENNA.

School of photography and reproduction	132
School of printing and illustrating	18
Total	150

EDUCATIONAL AND EXPERIMENT STATION FOR THE LEATHER INDUSTRY, VIENNA.

Theoretical and practical course	7

TRADE SCHOOL FOR ARTISTIC EMBROIDERY, VIENNA.

Trade school, proper	57
Course in restoring carpets and tapestry	5
Total	62

CENTRAL LACE-MAKING COURSE, VIENNA.

Course in lace sewing	6
Course in lace making	10
Course in crocheting	6
Total	22

INDUSTRIAL ART SCHOOL, PRAGUE.

Department for figure and ornamental drawing and painting	67
Department for figure and ornamental modeling	30
School of decorative architecture	9
School of ornamental modeling and embossing	6
School of decorative drawing and painting	5

	Pupils.
Trade school of artistic metal work	4
Trade school of wood carving	2
School of flower painting	8
School of textile art	6
Drawing and painting school for women	38
Artistic embroidery school for women	20
Evening and Sunday courses in industrial art	116
Total	311

Statistics of attendance at the Model Trade School for Basket Making were not available.

SCHOOLS FOR IMPORTANT GROUPS OF TRADES.

The instruction given in these institutions (*Fachschulen für die gewerblichen Hauptgruppen*), which are generally known as State industrial schools (*Staats-Gewerbeschulen*), is mostly of a higher character than that given in the ordinary trade schools and covers a number of trades and industries which have a common educational basis. They include schools of industrial art, for the building trades, for machinery construction, for the chemical industries, and for the textile trades. They are located only in large centers where they are of special advantage to the local industries. While each school is under one management and has one general plan of instruction, it is really a combination of several industrial trade schools, that portion of the instruction being differentiated which relates to each particular trade or industry.

The schools are of two grades—those known as the higher industrial schools (*höhere Gewerbeschulen*) and schools for foremen (*Werkmeisterschulen*). In half of the institutions both the higher industrial school and the school for foremen are included in the same institution, and in the larger cities the instruction in one institution covers several distinct groups of industries.

The schools for foremen (*Werkmeisterschulen*) were created for the purpose of permitting workers in the building, metal, textile, chemical, and art industries, such as carpenters, masons, stonecutters, cabinetmakers, machinists, tinsmiths, locksmiths, weavers, and employees in the chemical-technical works, to educate themselves in their respective spheres in the shortest time possible, and thus fit themselves for the positions of foremen, master builders, draftsmen, etc. The general conditions of admission are that the candidates shall have completed their regular public-school education. The pupils consist mostly of persons who have wholly or partly learned a trade and who wish to obtain such theoretical and technical knowledge as will fit them for higher-class work. Such instruction as is of a general educational character is here reduced to the smallest measure possible. According to local conditions the schools comprise several technical divisions for

building trades, metal working, textiles, and chemical work, as well as for small handicraft trades and artistic work. Each of these divisions comprises four semiannual courses. The two lower courses are so arranged that persons unable to attend the remaining courses can obtain sufficient training to fit themselves for such posts as overseers, stationary and locomotive engineers, firemen, etc. The courses for the building trades are given only in the winter terms so that students can work at their trades during the busy season. In order to make it easier for deserving persons to attend these courses scholarships are provided by the State and by local employers. In many respects this system of schools for foremen was copied after schools existing in Germany. The schools have workshops and laboratories.

The higher industrial schools (*höhere Gewerbeschulen*) are entirely different in character from the schools for foremen. This difference is not only in the qualifications for entrance and the destination of students, but also in the methods of instruction. Their purpose is to furnish a grade of instruction coming immediately after that of the *Realschule*, *Realgymnasium*, or *Gymnasium*. Their programmes embrace four classes of one year each. The object of the training is to prepare persons for the higher technical and administrative positions in industrial establishments, and particularly in the building, machinery, and chemical trades. The positions specially in view are those of master builders and contractors, superintendents of mechanical and metallurgical works, machine shops and gas works, proprietors and directors of manufacturing establishments, heavy motive-power works, master mechanics in the railway service, superintendents of breweries, distilleries, etc., and generally those positions which require both administrative ability and technical knowledge as well as a general scientific and liberal education.

These schools are organized into departments according to the subjects taught, viz, building trades, mechanical-technical, chemical-technical, and textile. The same school may include only one or several of these departments. The course of instruction in each case depends upon the particular object of the school. The general educational preparatory branches constitute the basis upon which the special trade education rests. As far as it is possible each pupil is trained for his own particular line of work. During the summer vacation the pupils are given opportunities for practical work in building enterprises, workshops, and factories. The schools have mechanical workshops and electrical and chemical laboratories. The teachers in both grades of the State industrial schools are partly graduates of the technical high schools, partly persons trained in industrial art, and partly persons qualified as teachers of intermediate schools. They are required to keep in close touch with their schools and the manufacturers of the vicinity, especially by doing work of practical value to the industries,

conducting special courses for manufacturers, etc. All of these schools have, in addition to the regular day courses, evening industrial continuation schools or special evening drawing or industrial courses.

On January 1, 1900, there were 18 State industrial schools in Austria and 1 was in course of construction. In addition, there were 2 group schools which were not maintained by the State. The following table shows the character and attendance of 18 of the State schools at the beginning of the school term 1899-1900:

ATTENDANCE AT THE STATE INDUSTRIAL SCHOOLS AT THE BEGINNING OF THE SCHOOL TERM 1899-1900, BY COURSES.

SCHOOLS FOR FOREMEN.

School for foremen at—	Courses.					
	Building trades.	Mechanical-technical.	Industrial art.	Weaving.	Dyeing.	Electro-technical.
Bielitz		68		14	26	
Brünn (Bohemian)	160	96				
Brünn (German)	153	66				
Brünn (textile school)				7		
Cracow			16			
Czernowitz	119					
Grätz	207		44			
Innspruck	97		59			
Lemberg	89		111			
Pardubitz	40	46				
Pilsen (Bohemian)	201	82				
Pilsen (German)	130	55				
Prague	111	66				
Reichenberg	158	66				
Salzburg	175		24			
Trieste			90			
Vienna (First district)	301					
Vienna (Tenth district)		62				53
Total	1,941	601	340	21	26	53

HIGHER INDUSTRIAL SCHOOLS.

State industrial school at—	Courses.				
	Preparatory.	Building trades.	Mechanical-technical.	Chemical-technical.	Textile.
Bielitz	52		78	83	
Brünn (German)	77	87	92		
Brünn (textile school)					39
Cracow	99	44	49	33	
Pilsen (German)	72	64	93		
Prague		142	147	54	
Reichenberg	90	56	105	69	
Trieste	40	30	37		
Vienna (First district)	90	115	110		
Total	520	538	711	239	39

Of the 18 schools shown in the above table, 9 comprise both the higher industrial school and the school for foremen in the same institution. The remaining 9 institutions are schools for foremen only. In addition to the attendance enumerated above, a considerable number of persons attended special courses, continuation schools, and drawing halls connected with these institutions. Following is a state-

ment of the total attendance of the 18 institutions at the beginning of the winter term 1899–1900.

	Pupils.
Regular day courses at the 9 higher industrial schools	2,047
Regular day courses at the 18 schools for foremen	2,982
Special courses at 12 schools	2,117
Commercial day courses at 1 school	195
Industrial continuation classes at 16 schools	3,219
Commercial continuation classes at 2 schools	228
Open drawing halls at 4 schools	207
Miscellaneous courses at 6 schools	867
Total attendance	11,862

The industrial schools which were not maintained by the State are the Higher Industrial School, at Hohenstadt, and the Lower Austrian Provincial Industrial School, at Vienna.

During the year 1898 the ministry of education expended 1,448,000 gulden ($587,888) for the maintenance of this class of schools.

GENERAL HANDICRAFT SCHOOLS.

While the schools for important groups of trades and for individual trades do not admit pupils until they have passed their fourteenth year of age, and are therefore inaccessible to persons who have to begin to earn a livelihood at that time, the general handicraft schools (*allgemeine Handwerkerschulen*) admit pupils at the age of 12 years, or before they have passed the compulsory school age. The trade schools educate the pupils for specific trades, but the handicraft schools, which are more in the nature of manual-training schools, give a thorough preparatory training for industrial work in general, especially such as will tend to supply the handicraft trades with a select class of young workingmen. In this way they offer to the sons of workingmen an opportunity to obtain a training in practical work, which they can not obtain in the ordinary public schools. The general handicraft schools therefore include, in a two or three years' course, a continuation of the regular public-school education, combined with instruction in a number of branches of work which is of practical value in industrial occupations. Instruction in drawing is specially emphasized, manual training is combined with theoretical work, and for this purpose modeling rooms and workshops are attached to the schools. The handicraft schools are not intended to replace apprenticeships, but only to constitute a good preparatory training therefor. Continuation schools and public drawing rooms are also attached to these handicraft schools. The teaching personnel consists of thorough master workmen for the practical work and of regular graduated teachers for the public-school instruction. These schools have existed only about fifteen years and on account of their great expense are few in number.

As these institutions are manual training rather than trade schools a detailed description is not given. In order to give a general idea of

the scope of the instruction, the following statement of the subjects taught and the hours devoted to each is shown:

PROGRAMME OF INSTRUCTION AT A GENERAL HANDICRAFT SCHOOL AS PRESCRIBED BY THE MINISTERIAL ORDER OF MAY 5, 1896.

Subjects taught.	Hours per week.		
	First year.	Second year.	Third year.
Religion	1	1	.....
Language and business forms	4	3	.....
Geography	2	1	.....
Elements of physics and mechanics	2	2	2
Materials and technology	2	2	3
Industrial arithmetic	3	4	2
Bookkeeping and industrial law	.....	2	2
Free-hand drawing	6	2	4
Geometry and geometrical and perspective drawing	6	4	2
Industrial drawing	.....	3	8
Modeling	.....	6	4
Manual training	6	4	14
Penmanship	2	9	.....
Total	34	43	41

The following table shows the attendance at each of the handicraft schools at the beginning of the winter term 1899–1900:

ATTENDANCE AT THE GENERAL HANDICRAFT SCHOOLS, WINTER TERM, 1899–1900.

Location of school.	Handicraft school.	Open drawing hall.	Continuation school.	Total.
Lintz	107	20	219	346
Klagenfurth	55	42	168	265
Imst	46	10	22	78
Jaromirz	70	20	143	233
Kladno	90	17	352	459
Tetschen	104	41	145	290
Leitomischl	37	30	134	201
Jung-Buntzlau	104	75	146	325
Kolin	98	10	188	296
Wolin	67	20	52	139
Kuttenberg	74	20	320	414
Total	852	305	1,889	3,046

During the year 1898 the ministry of education expended 94,000 gulden ($38,164) for the support of these handicraft schools.

Of the 11 State handicraft schools enumerated above 5 are communal schools receiving State subsidies, and are located at Jung-Buntzlau, Kolin, Kuttenberg, Leitomischl, and Wolin.

SCHOOLS FOR PARTICULAR TRADES.

These schools (*Fachschulen für einzelne gewerbliche Zweige*) are intended to promote important individual trades, and are therefore located not only in the larger industrial centers but also in smaller communities where certain individual trades have attained some importance. This applies specially in the case of weaving, glass and ceramic industries, and stone and metal working. Another important object of these schools is to revive and improve home or cottage

industries, which are still carried on to a considerable extent in many localities in Austria, but in which, owing to the crude and primitive methods of production, the persons engaged had been unable to earn more than a scant livelihood. It is intended that these schools should teach such workers the best methods of production in accordance with the spirit of modern times and with modern appliances.

The schools differ greatly in the scope of their work as well as in their attendance, the latter ranging from six pupils with one teacher to several hundred pupils with a dozen or more teachers in one school. A distinguishing mark of all these schools is the great prominence which is given to drawing. The length of the course of training varies, extending in some cases to four years.

In most schools pupils, in order to be admitted, are required to have completed their regular common-school education and to have passed the age of 14 years. The certificates of graduation in many of these trade schools take the place of the handicraft certificates (*Befähigungsnachweis*) required by the industrial code, and entitle the holder to the independent practice of his trade. The institutions which can issue such certificates are specially designated by official orders of the ministry of education with the approval of the ministry of commerce.

The teaching personnel of these schools consists partly of instructors trained in pedagogy and partly of experts in technical or artistic work. The management is usually intrusted to persons who have received a high-school education, these persons being in many cases architects or mechanical engineers. For the industrial art branches teachers are usually selected who have been educated in the industrial art school of the museum at Vienna. Aside from the actual teachers, all trade schools have for the practical training, especially for instruction in the workshops, master workmen who were specially trained as superintendents or foremen in large manufacturing establishments. To the last-mentioned class of instructors usually belongs the difficult task of giving to the pupils a training which is to replace apprenticeship.

The trade schools for particular industries may be grouped as follows: (1) schools for lace work and embroidery; (2) schools for weaving, knitting, etc.; (3) schools for wood, iron, and stone work; (4) schools for earthenware and glassware; (5) schools for metal working; and (6) schools for various other trades.

In 1899, according to an official report published by the Austrian ministry of education, there were 96 State trade schools and 62 private and State-subsidized schools in Austria. In 1898 the ministry of education expended 1,004,000 gulden ($407,624) for schools of this

character. The following table shows the attendance at each of the 96 State trade schools at the beginning of the school term 1899-1900:

ATTENDANCE AT STATE SCHOOLS FOR PARTICULAR TRADES, 1899-1900.

Character of school and locality.	Day trade courses.			Continuation courses.	Other courses.	Total.
	Regular pupils.	Special pupils.	Total pupils.			
SCHOOLS FOR LACE WORK AND EMBROIDERY.						
Lace work:						
Chiapovano	33	8	41	.....	.....	41
Cles	24	3	27	.....	.....	27
Dol-Otlica	82	16	98	.....	.....	98
Flitsch	48	1	49	.....	.....	49
Gossengrün	6	8	14	.....	.....	14
Idria	62	3	65	.....	102	167
Isola	33	.....	33	.....	.....	33
Luserna	46	7	53	.....	.....	53
Predazzo	65	.....	65	.....	.....	65
Provcis	24	.....	24	.....	.....	24
Tione	42	4	46	.....	.....	46
Embroidery:						
Dornbirn	16	.....	16	.....	.....	16
Graslitz	18	4	22	.....	.....	22
Lace work and embroidery: Laibach	49	8	57	.....	36	93
Total	548	62	610	.....	138	748
SCHOOLS FOR WEAVING, KNITTING, ETC.						
Weaving:						
Bennisch	17	1	18	.....	21	39
Frankstadt	9	.....	9	6	.....	15
Freudenthal	14	2	16	7	4	27
Haslach	3	.....	3	.....	.....	3
Hohenelbe	36	.....	36	.....	49	85
Humpoletz	11	.....	11	.....	6	20
Jägerndorf	22	.....	22	.....	36	58
Königinhof	18	.....	18	69	.....	87
Landskron	29	1	30	.....	.....	30
Lomnitz	38	.....	38	.....	14	52
Nachod	30	1	31	31	.....	62
Neu Bistritz	12	.....	12	.....	1	13
Neutitschein	7	.....	7	.....	16	23
Prossnitz	9	9	18	.....	39	57
Reichenau a. d. Kn	7	1	8	.....	6	14
Reichenberg	39	8	47	70	.....	117
Rochlitz	28	.....	28	.....	30	58
Römerstadt	14	1	15	.....	47	62
Rumburg	17	1	18	56	.....	74
Schluckenau	26	11	37	77	69	183
Schönberg	42	1	43	23	.....	66
Starkenbach	5	.....	5	.....	39	44
Starkstadt	27	.....	27	.....	.....	27
Sternberg	18	.....	18	16	17	51
Warnsdorf	22	9	31	.....	96	127
Wildenschwert	28	.....	28	3	.....	31
Zwittau	23	.....	23	29	17	69
Knitting:						
Schonlinde	20	7	27	16	62	105
Strakonitz	9	.....	9	.....	.....	9
Weaving and knitting: Asch	26	.....	26	80	.....	106
Textiles: Vienna	30	6	36	255	.....	291
Total	639	59	698	738	569	2,005
SCHOOLS FOR WOOD, IRON, AND STONE WORK.						
Woodwork:						
Arco	11	2	13	15	84	112
Bergreichenstein	53	.....	53	92	.....	145
Bozen	43	4	47	101	23	171
Chrudim	79	2	81	219	81	381
Cortina d'Ampezzo	30	9	39	52	95	186
Ebensee	44	4	48	48	18	114
Gottschee	33	1	34	.....	.....	34
Grulich	40	3	43	53	.....	96
Hallein	51	11	62	61	108	231
Hallstatt	29	9	38	.....	30	68
Kimpolung	58	.....	58	21	.....	79
Kolomea	53	.....	53	.....	.....	53
Königsberg	29	2	31	63	48	142
Laybach	75	8	83	.....	45	128

ATTENDANCE AT STATE SCHOOLS FOR PARTICULAR TRADES, 1899-1900—Concluded.

Character of school and locality.	Day trade courses.			Continuation courses.	Other courses.	Total.
	Regular pupils.	Special pupils.	Total pupils.			
SCHOOLS FOR WOOD, IRON, AND STONE WORK—concluded.						
Woodwork—Concluded.						
Mariano	22	1	23	70	.....	93
Tachau	14	.....	14	.....	.....	14
Villach	56	17	73	.....	133	206
Wal. Meseritsch	75	.....	75	93	88	256
Wallern	41	.....	41	.....	71	112
Würbenthal	20	.....	20	.....	31	51
Zakopana	100	.....	100	.....	.....	100
Basket making:						
Bleistadt	14	9	23	.....	.....	23
Fogliano	9	3	12	.....	.....	12
Melnik	19	.....	19	.....	.....	19
Zaga	(a)	(a)	(a)	(a)	(a)	(a)
Stonework:						
Horitz	64	16	80	.....	89	169
Laas	19	7	26	.....	.....	26
Wood and iron work: Bruck a. d. Mur	40	.....	40	42	49	131
Wood and stone work: Trent	9	6	15	42	.....	57
Total	1,130	114	1,244	972	993	3,209
SCHOOLS FOR EARTHENWARE AND GLASSWORK.						
Earthenware:						
Bechin	41	5	46	33	30	109
Oberleutensdorf	19	3	22	.....	.....	22
Teplitz	54	6	60	128	5	193
Znaim	50	6	56	112	22	190
Glasswork:						
Haida	31	5	36	159	.....	195
Stein Schönau	18	9	27	88	74	189
Total	213	34	247	520	131	898
SCHOOLS FOR METAL WORK.						
Machine construction:						
Klagenfurth	87	.....	87	91	27	205
Kommotau	76	.....	76	.....	.....	76
Prerau	58	.....	58	.....	32	90
Housesmithing:						
Königgrätz	69	1	70	.....	.....	70
Swiatniki	62	1	63	.....	.....	63
Iron and steel work:						
Fulpmes	18	1	19	37	.....	56
Steyer	61	1	62	.....	.....	62
Firearms making: Ferlach	25	2	27	.....	.....	27
Rough-iron work: Sulkowice	22	3	25	.....	.....	25
Metal work: Nixdorf	17	2	19	98	20	137
Total	495	11	506	226	79	811
MISCELLANEOUS SCHOOLS.						
Musical-instrument making:						
Graslitz	179	105	284	.....	.....	284
Schönbach	276	69	345	.....	.....	345
Artistic brazing, engraving, and bronze work:						
Gablonz	56	2	58	196	37	291
Drawing and modeling: St. Ulrich	20	4	24	12	97	133
Precious-stone grinding and setting: Turnau	25	6	31	.....	27	58
Watch and clock making: Karlstein	30	3	33	.....	.....	33
Total	586	189	775	208	161	1,144
RECAPITULATION.						
Schools for lace work and embroidery	548	62	610	.....	138	748
Schools for weaving, knitting, etc	639	59	698	738	569	2,005
Schools for wood, iron, and stone work	1,130	114	1,244	972	993	3,209
Schools for earthenware and glasswork	213	34	247	520	131	898
Schools for metal work	495	11	506	226	79	811
Miscellaneous schools	586	189	775	208	161	1,144
Total	3,611	469	4,080	2,664	2,071	8,815

(a) Not reported.

Following is a list of the places in which are located the 62 private and State-subsidized trade schools in Austria for which no statistics of attendance could be obtained:

PRIVATE AND STATE-SUBSIDIZED TRADE SCHOOLS.

Lace work: Drosau, Gottesgab, Heinrichsgrün, and Wamberg, in Bohemia; Kanczuga and Zakopana, in Galicia; Prettau, in Tyrol.

Embroidery: Cracow and Maków, in Galicia.

Weaving: Gliniany, Gorlice, Korczyna, Kosów, Krossno, Lancut, Rakzawa, Rychwald, and Wilamowice, in Galicia.

Woodwork: Bleiberg and Malburgeth, in Carinthia; Kalwarya and Stanislau, in Galicia; Wal. Meseritsch, in Moravia.

Basket making: Königsaal, Rothwasser, Senftenberg, Silber-Bergstadt, and Wolin, in Bohemia; Rattendorf and Steinfeld, in Carinthia; Czerwona Wola, Džurów, Rudki, Skolyszyn, Stryhańce, Wojslaw, and Zator, in Galicia; Zwettel, in Lower Austria; Neustadtl, Roznau, Wisowitz, and Wsetin, in Moravia; Hillersdorf, in Silesia; Denno, Male, and Proveis, in Tyrol.

Stonework: Friedeberg and Saubsdorf, in Silesia.

Wagon making: Grybow and Grzymalow, in Galicia.

Wagon making and joining: Kamionka Strzumilowa, in Galicia.

Earthenware: Kolomea, Poreba Zegota, and Touste, in Galicia.

Shoemaking: Alt-Sandec, Uhnów, and Witkowo, in Galicia.

Music: Petschau and Pressnitz, in Bohemia.

Rope making: Radymno, in Galicia.

Iron and steel work: Waidhofen a. d. Ipbs, in Lower Austria.

Trade drawing: Aussee, in Styria.

INDUSTRIAL CONTINUATION SCHOOLS.

These schools (*gewerbliche Fortbildungsschulen*) are intended to give to the great mass of working people who are already engaged in gainful occupations, and therefore have not the time to attend day schools, an opportunity to extend and to increase the knowledge necessary for their occupations by giving theoretical instruction in the evenings and on Sundays. With regard to their purposes they may be divided into general industrial continuation schools (*allgemeine gewerbliche Fortbildungsschulen*), trade continuation schools (*fachliche Fortbildungsschulen*), and continuation schools for girls.

The general industrial continuation schools are conducted by virtue of a decree of the ministry of education, dated February 24, 1883. They are maintained by employers of labor in their respective localities and are subsidized, as a rule, by the State to the extent of one-third of their annual expenditures. The State, through the ministry of education, further encourages these schools by maintaining model continuation schools in connection with the State industrial institutions, by supplying educational material, and by training teachers for these schools by means of special vacation courses at the State industrial institutions.

The attendance at these industrial continuation schools is not usually compulsory, but the industrial code of Austria requires employers to

allow employees under 18 years of age the necessary time for attendance at these schools. The instruction generally covers about seven months each year, beginning in the fall and ending in the spring. The branches taught are elementary and technical drawing, business forms, industrial mathematics, and bookkeeping.

The trade continuation schools (*fachliche Fortbildungsschulen*) are intended for individual trades or groups of similar trades. In these schools the instruction is much more specialized than in the preceding class, special attention being given to the needs of particular trades and industries. Among these schools may be considered the trade continuation courses maintained in connection with the trade schools for particular industries. The schools offer to persons following particular trades, but unable to attend the day schools, opportunities to continue their particular technical training on Sundays and evenings. In Vienna there are many of these trade continuation schools maintained by the trade guilds and subsidized by the State. The instruction given in these schools covers a two to three years' course of about ten hours per week, and comprises theoretical as well as industrial training.

In addition to the above-mentioned industrial continuation schools there are also in a number of cities industrial continuation schools for girls. Their object is to educate girls who wish to be trained in industrial or commercial pursuits. They are usually created by private employers and subsidized by the State.

Complete statistics of attendance at industrial continuation schools were not available. The attendance at continuation schools conducted in connection with the State industrial schools, the general handicraft schools, and the State schools for particular trades, is shown in connection with the general description of these institutions. Following is a recapitulation of the attendance at these continuation schools at the beginning of the school term 1899–1900:

ATTENDANCE AT INDUSTRIAL CONTINUATION SCHOOLS CONDUCTED IN CONNECTION WITH OTHER INSTITUTIONS, 1899–1900.

Class of school.	Schools.	Pupils.
State industrial schools	16	3,219
Handicraft schools	11	1,889
Weaving schools	14	738
Schools for wood and stone work	15	984
Schools for earthenware and glass work	5	520
Schools for metal work	3	226
School for brazing, engraving, and braze work	1	196
Total	65	7,772

In addition to these there were in 1899 about 650 industrial continuation schools in the Austrian Empire which were not attached to other

technical schools. Their total attendance was estimated to be about 100,000. On pages 548 to 560 are given a description and statistics of the industrial continuation schools in the city of Vienna.

GENERAL DRAWING SCHOOLS.

Besides the various trade and technical schools above mentioned there are schools for drawing and modeling (*Zeichen- und Modellierschulen*) which offer to all persons, regardless of occupation, opportunities for perfecting themselves in drawing and modeling. These schools do not possess a special trade or technical character. Some are connected with museums or other educational institutions, while others are conducted independently. Of the latter, three in Vienna and one in Brünn are subsidized by the State. The total attendance of these four schools at the beginning of the school term 1899–1900 was 262 persons.

To recapitulate, the total attendance at the State industrial educational institutions of Austria, excluding continuation schools, was as follows at the beginning of the school term 1899–1900:

ATTENDANCE AT STATE INDUSTRIAL EDUCATIONAL INSTITUTIONS, 1899–1900.

Class of school.	Schools.	Pupils.
Central industrial educational institutions	7	1,871
Schools for important groups of trades	18	11,862
General handicraft schools	11	3,046
Schools for particular trades	96	[a]8,815
General drawing schools	4	262
Total	136	25,856

[a] Not including 1 school not reported.

The total amount expended by the State in 1900 for industrial educational institutions, including the subsidized museums and commercial schools, was 8,222,000 crowns ($1,669,066).

The following table, compiled from statistics contained in a work entitled "*Die Entwicklung des gewerblichen Unterrichtswesens in Oesterreich*," by Baron Rudolph von Klimburg, an officer of the Austrian Government, shows the development of State and other institutions for trade and technical education in Austria from 1877 to 1895:

TRADE AND TECHNICAL INSTITUTIONS, AND ATTENDANCE AT THE CLOSE OF EACH SCHOOL TERM, 1877 TO 1895.

Year.	Institutions.					Teachers.	Attendance.				
	Schools for important groups of trades.	General handicraft schools.	Schools for particular trades.	Continuation and drawing schools.	Total.		Schools for important groups of trades.	General handicraft schools.	Schools for particular trades.	Continuation and drawing schools.	Total.
1877	10	.....	72	127	209	900	712	.....	(a)	b16,905	17,617
1878	10	.....	73	173	256	1,108	988	.....	(a)	b22,866	23,854
1879	10	.....	75	195	280	1,210	1,067	.....	(a)	b28,357	29,424
1880	10	.....	78	207	295	1,247	878	.....	(a)	b26,295	27,173
1881	10	.....	80	227	317	1,425	1,039	.....	(a)	b28,227	29,266
1882	11	.....	118	216	345	1,516	1,314	.....	(a)	b30,440	31,754
1883	16	.....	92	302	410	1,980	1,615	.....	3,677	30,862	36,154
1884	17	.....	106	320	443	2,253	2,066	.....	4,937	35,675	42,678
1885	17	.....	110	348	c492	2,547	2,392	.....	5,498	37,883	45,773
1886	19	.....	117	378	514	2,868	2,482	.....	6,120	42,371	50,973
1887	20	.....	117	412	549	3,134	2,502	.....	5,763	47,266	55,531
1888	21	.....	120	439	580	3,450	2,763	.....	5,710	49,468	57,941
1889	21	6	118	474	619	3,754	2,948	346	5,703	54,442	63,439
1890	23	8	129	483	643	4,060	2,941	474	5,952	58,340	67,707
1891	19	8	139	536	702	4,416	3,236	742	8,131	61,354	73,463
1892	20	8	145	578	751	4,802	3,366	768	9,277	65,423	c79,834
1893	20	8	147	631	806	5,176	3,476	771	9,586	70,754	84,587
1894	20	10	154	661	845	5,490	3,589	799	9,602	73,791	c87,601
1895	20	11	152	708	891	5,875	3,849	1,022	9,607	78,162	92,640

a Included in continuation and drawing schools.
b Including schools for particular trades.
c This total does not agree with the sum of the items; the figures given, however, are according to the original.

The table following, obtained from the same source, shows the expenditures of the Austrian ministry of education for industrial education each year from 1892 to 1898:

EXPENDITURES OF THE MINISTRY OF EDUCATION FOR INDUSTRIAL EDUCATION IN AUSTRIA, 1892 TO 1898.

[Original figures were given in thousands of gulden.]

Year.	Expenditures.					
	Schools for important groups of trades.	General handicraft schools.	Schools for particular trades.	Industrial continuation schools.	Other.	Total.
1892	$384,076	$30,450	$304,094	$63,742	$113,274	$895,636
1893	414,526	30,044	317,898	70,644	116,928	950,040
1894	425,894	32,886	334,544	78,764	122,206	994,294
1895	469,742	34,104	354,438	86,884	129,920	1,075,088
1896	486,388	34,916	373,520	93,380	140,070	1,128,274
1897	523,334	35,728	395,444	101,500	146,972	1,202,978
1898	587,888	38,164	407,624	112,868	156,716	1,303,260

DEVELOPMENT AND SUPERVISION OF THE APPRENTICESHIP SYSTEM.

Austria, like Germany, while perfecting her system of industrial schools, has by no means abandoned the appenticeship system as a valuable means for the imparting of trade training. On the contrary, the effort now being made to perfect this system constitutes one of the most important and interesting phases of the modern movement for the making of skilled workmen. It has been shown that the chief means

by which the apprenticeship is sought to be preserved and brought into harmony with existing industrial conditions is through the promotion of trade associations after the model of the old guild. The same method and action is followed by Austria. The old guilds, for many years declining in importance, had at the time of the enactment of the industrial code of 1859 reached the last stages of decay. This code, as one of its main purposes, attempted to restore the power of these associations. It made it obligatory upon employers to maintain their relations with their guilds, or to restore them when they had been discontinued

Further efforts to reorganize the guilds so as to bring them more in harmony with changed industrial conditions, and to make of them efficient organizations, were made in the laws of March 15, 1883, and February 23, 1897. The law of 1883 is of especial importance. It established the guilds upon a new basis, which exists at the present time, as the law of 1897 introduced but slight modifications. The most important feature of the law of 1883 is that whereby the fundamental difference is recognized between the conditions in the large industrial establishments or factories and those in the handicraft trades. The true sphere of activity for the guilds was seen to be in bringing together for purposes of mutual benefit the small independent employers and artisans. The law, therefore, exempted the heads of factories from the obligation of membership in the guilds. The powers and duties of the guilds as regards the small employers and handicraftsmen, however, were considerably enlarged. It was hoped through the guilds to enable these classes to hold their own against the growing power of the larger establishments.

The principle of obligatory guilds is unreservedly accepted. The law provides that whoever carries on a trade on his own account or as a contractor, becomes by virtue of his undertaking such trade a member of the guild for his industry and district. At the same time all the employees become associates (*Angehörige*).

The following statement of the functions of these guilds shows to how large an extent they are bodies to look after the training of apprentices. Their duties are (1) to maintain harmonious relations between employers and their employees, especially in respect to the organization of the labor force, the provision of guild shelters or lodges, and the securing of employment for persons out of work; (2) to provide for a satisfactory apprenticeship system, by the preparation of regulations, subject to the approval of the authorities, regarding the technical and moral instruction of apprentices, the length of their terms of service, examinations, etc., and the watching over the compliance with these regulations, the ratification of the certificates granted to them, and the determination of the conditions to be required for the keeping of apprentices, and the number of appren-

tices in proportion to the number of other employees; (3) to create arbitration committees for the adjustment of disputes between members of the guilds and their employees arising out of their labor, apprenticeship, and wage relations, and to create arbitration institutions for the adjustment of disputes between members of a guild, for which purpose several guilds may unite; (4) to further the creation of and themselves to establish and maintain trade schools; (5) to care for sick employees through the creation of new or the support of existing sick funds; (6) to care for sick apprentices; and (7) to prepare an annual report of the work of the guild which may be of use in the preparation of trade statistics. In addition to this regular report, guilds must, whenever called upon, furnish the chambers of commerce and industry of their districts information or advice upon particular subjects within their province. They must also especially give their opinion to the industrial authorities, whenever it is requested, concerning the granting of a trade certificate (*Gewerbeschein*) authorizing the prosecution of a handicraft trade, or a license to carry on a licensed trade, when especial qualifications are necessary, and when the evidence concerning the competence of the applicant does not seem to be sufficient. The guilds may also make recommendations upon their own initiative to the chambers of commerce and industry.

The guilds have the right to impose and collect entrance fees or incorporation dues from their members and apprenticeship fees to be paid by the apprentices after the completion of their terms of service. The amount of these dues is fixed by the political authorities after obtaining a decision of the general assembly of the guild. Of the receipts from apprenticeship fees, not more than one-half may be used for general expenses; the other half must be used for the purpose of educating or otherwise benefiting the apprentices.

These guilds see that the provisions of the law regarding apprentices are carefully carried out. The law relating to this subject specifies that only competent persons shall be entitled to have apprentices, and this right may be withdrawn if the employer misconducts himself or neglects the training of apprentices who are under his charge. The following are some of the important provisions of the law regarding the serving of apprenticeships in the Empire:

The engagement of an apprentice must be by an express contract, which must be definitely concluded at the end of the probationary period. This contract may be verbal or in writing. If verbal, it must be entered into before the executive board of the guild to which the employer belongs, or, when such an organization is not in existence, before the communal authorities. If the contract is in writing, it must be immediately transmitted to the guild or communal authorities. Whether verbal or in writing, the guild or communal authorities must enter the contract in a register to be kept for that purpose.

The contract must contain (1) the name and age of the employer, the industry which he carries on, and the address of his place of business; (2) the name, age, and residence of the apprentice; (3) the name, residence, and occupation of his parent, guardian, or other legal representative; (4) the date and duration of the apprenticeship contract; (5) a clause stating that in addition to the other legal obligations of the parties the employer binds himself to instruct the apprentice in his trade, or to have it done by a competent representative, and the apprentice will be required to apply himself diligently to his trade; (6) clauses showing the conditions of the contract as regards apprenticeship fees or wages, board, lodging, and clothing, the duration of the apprenticeship term, and the guild fee for the certificate of indenture and release.

The more important features of the contract must be entered by the communal authorities in the labor book of the apprentice.

Except in cases otherwise specially provided for by law, the term of apprenticeship must be not less than two nor more than four years in nonfactory trades and not more than three years in factory trades. When an apprentice has served a portion of his term with one employer and is regularly transferred to the service of another, the time so served must be included in the entire term.

The first four weeks of the apprenticeship term must be considered as a period of probation, during which the contract can be terminated by either party. This period may be extended, but must not be longer than three months.

The employer must interest himself in the industrial education of the apprentice, and must not deprive him of the time and opportunity necessary for this purpose by using him for other purposes. He or his representative must look after the morals and deportment of minor apprentices, both in and outside the workshop. He must require of the apprentice diligence, good manners, and the fulfillment of his religious duties. He must not illtreat the apprentice, and must protect him from illtreatment on the part of fellow-workmen or members of his household. He must see that the apprentice is not required to perform work, such as transporting burdens, etc., which is beyond his physical strength.

The employer or his representive is further required to allow apprentices who have not yet been absolved from the obligation to attend an industrial continuation school, or an institution of equal merit, the necessary time for attendance at the existing general industrial continuation schools (*gewerbliche Fortbildungsschulen*), as well as the trade continuation schools (*fachliche Fortbildungsschulen*), and also to see that they do attend such schools.

Upon the termination of the apprenticeship, the employer must furnish the apprentice with a certificate (*Zeugniss*), showing the trade in which the apprenticeship was served, the conduct of the apprentice,

and the technical education that he has received. In case the apprenticeship is regularly completed, and the employer is a member of a guild, this body must prepare a formal apprenticeship certificate (*Lehrbrief*). In both cases the material contents of the certificate must be entered in the labor book of the apprentice and be attested by the local police authorities.

These provisions of the law are by no means a dead letter. They set forth the actual conditions under which most of the handicraft trades are learned at the present time. The practical instruction is obtained in actual shopwork under competent instructors, while matters of theory, trade drawing, etc., are taught in the industrial or trade continuation schools.

INDIVIDUAL SCHOOLS.

In the foregoing pages an attempt has been made to trace the development and to show the present status of trade and technical education in Austria as well as to describe the various classes of educational institutions. In the pages which follow detailed accounts are given of one or more important or typical schools of each class, arranged in the order of the classification given.

CENTRAL INDUSTRIAL EDUCATIONAL INSTITUTIONS.

A detailed description need be given of only one of these institutions. The one selected, the Technological Industrial Museum (*Technologisches Gewerbe-Museum*), Vienna, is probably one of the most complete and best equipped institutions for industrial education in Europe.

TECHNOLOGICAL INDUSTRIAL MUSEUM, VIENNA.

After repeated attempts, made both by the State and by private individuals, to organize a central technological institution the Lower Austrian Industrial Society (*Niederoesterreichischer Gewerbeverein*) in 1879 founded as a nucleus for such an institution a department or school of woodworking. In 1881 a department for tinctorial chemistry was added. In 1888 the proceeds of an industrial exposition at Vienna, amounting to 55,000 florins ($18,975), were devoted to this institution. About this time trade schools and experiment stations were established in different parts of Vienna as adjuncts to this institution, and schools for metal work and electro-technics were added. More recently testing and experimental stations for the paper industry, building materials, machinery, electricity, and the brewing industry were created in connection with the industrial museum. The school, which in 1879 opened with a few instructors and 44 pupils, had on December 31, 1899, a total of 147 teachers and 1,317 pupils.

The educational work of the museum, as at present organized, consists of trade schools having all-day sessions, courses for master

workmen, and special evening and Sunday classes. The day schools comprise a department for the wood industry, consisting of a lower and a higher trade school for cabinetmaking, joining, and a special course in paper manufacturing; a department for the chemical industries, consisting of a trade school for dyeing, a higher trade school for the chemical industries, and a school for tinctorial chemistry; a department for the metal industries, consisting of a lower and a higher school for iron and steel working and a special course for boiler tenders and enginemen; a department for electro-technics, consisting of a lower and a higher trade school of electro-technics. The courses for master workmen are for shoemakers, joiners, tailors, locksmiths, and carpenters. The special evening and Sunday courses relate to drawing, electro-technics, and technological and miscellaneous subjects.

DEPARTMENT OF WOOD INDUSTRY.

This department is intended to educate persons in the cabinetmaking and joining trades. The attendants are of two kinds—regular and special. The regular pupils are persons who desire to obtain a complete training in the school and who follow the prescribed programme of studies. Special pupils are those who follow only certain portions of the programme in order to perfect themselves in some features of their trade. The school is in session from October 1 to July 31.

Upon admission to the school a matriculation fee of 4 crowns ($0.81) is charged. The regular pupils pay a tuition of 240 crowns ($48.72) per year. The payment of this tuition may be wholly or partly dispensed with in the case of worthy pupils without means who have attended at least one half-year term. All instruction materials and apparatus which the pupils require for their theoretical work are furnished at their own cost. The copies and models used are supplied by the school. For the shop work each pupil must have a complete set of working tools, which he may purchase in monthly installments or rent from the museum at 2 crowns ($0.41) per month. The objects made in the shops belong to the institution. The proceeds from their sale, after deducting cost of materials used, are devoted to the fund for the aid of needy and worthy pupils.

The lower trade school for cabinetmaking and joining is intended to replace the regular shop apprenticeship by giving a practical and theoretical training in furniture and joinery work. The course of instruction covers four years. In order to be admitted persons must have completed their fourteenth year of age and their public school education and must be in proper physical condition. Pupils can not pass from one year's grade to another without having passed a satisfactory examination. Upon successfully completing the four years' course pupils receive graduating certificates which entitle them by law to all the privileges of skilled artisans. The hours of instruction are from 8 a. m. to 12 m. and from 2 to 6 p. m. During the third

and fourth years lectures are given once or twice a week during the winter term, and in the fourth year practical work is required on Sundays from 8 to 10 a. m. During the summer term pupils are occasionally taken on excursions to woodworking establishments in the vicinity.

The following statement shows the subjects taught and the hours per week devoted to each in the lower trade school for cabinetmaking and joining for each of the four years of the full course:

First year: German language and business forms, 6; arithmetic, 4; free-hand drawing, 6; geometric and projective drawing, 8; elements of physics and mechanics, 2; shopwork, 18.

Second year: Arithmetic and elements of algebra, 4; free-hand drawing, 4; geometric and perspective drawing, 6, trade drawing, 4; physics, winter term, 3; shopwork, winter term, 23; summer term, 31.

Third year: Architectural styles, 4; ornamental drawing, 2; trade drawing, cabinetmaking, 6; trade drawing, joinery work, 4; general chemistry, 2; mechanics, 3; practical arithmetic, 1; shopwork, winter term, 24; summer term, 28.

Fourth year: Ornamental drawing, 2; trade drawing, cabinetmaking, 6; trade drawing, joinery work, 4; arrangement and management of workshops, winter term, 1; technology of wood, winter term, 2; wood joining, 2; practical bookkeeping and correspondence, winter term, 2; industrial hygiene and prevention of accidents, winter term, 2; technical finishing processes, winter term, 4; shopwork, winter term, 27; summer term, 40.

Following is a synopsis of the foregoing course:

German language and business forms: General exercises in oral and written expression and the most important forms of business letters.

Mathematics: Practical arithmetic, including proportion and percentage; fundamental operations of algebra, including equations of the first degree with one or more unknown quantities; elements of geometry with demonstrations of theorems, especially with reference to the theory of triangles, the square, and the circle.

Free-hand drawing: Instruction in this subject has for its aim the attainment of a certain degree of skill in the presentation of geometric forms by free-hand. Exercises in measuring by the eye and preparation for ornamental drawing. This object is attained by extending the elementary instruction received in the common school to drawing simple plane ornaments from copies in outlines and color, and to a systematic course of drawing more difficult plane ornaments and simple gypsum models.

Geometric and projective drawing: Development of the fundamental forms of plane geometry and stereometry, with special reference to the needs of the cabinetmaker. Elements of descriptive geometry limited to the forms of projections and various profiles as found in cabinetmaking. Essentials of shades, shadows, and perspective, in so far as they are necessary for correct and attractive drawings of objects in cabinetmaking and joining.

Architectural styles: Elements of profiles; their assembling for decorative purposes; their use in frames and casings; kinds of casings; the various kinds of columns.

Ornamental drawing: Profile, checkerwork, ornamental gypsum models.

Trade drawing: In trade drawing particular attention is given to exactness of form and to technically correct construction of objects. The technical constructive side of cabinetmaking and joining is therefore emphasized in this course, while the æsthetic side, which becomes especially prominent in decorative cabinetmaking, receives consideration only in so far as it appears indispensable in a technical school; but it is constantly borne in mind that it is not the purpose of this course to give students an artistic education.

Furniture making: Theory of profiles—Drawing of elementary profiles in regular order, combining them with reference to their practical application; drawing of profiles, casings, doors for wardrobes, wainscoting. Theory of style—Drawings of the various kinds of columns, with illustrations for transferring them to wood. Furniture drawing—Beginning with the drawing of plain furniture on a scale of one-tenth or one-fifth of its natural size, considering the details in their natural size, sketching of ordinary types of furniture in one-tenth or one-fifth of its natural size, and advancing gradually to higher grades of objects, always following the same methods. Drawing of wainscoting.

Joining: At the beginning of this course a brief synopsis of architecture is given as an introduction to trade drawing. This is followed by joining, its special application, construction of floors, doors, and windows; sketches from models, drawing of these sketches in one-tenth or one-fifth of their natural size, and sketches of details from drawings on a smaller scale.

Elements of physics and mechanics: General properties of bodies, statics, motion.

Physics: Sources and diffusion of heat, expansion of bodies by heat, specific heat.

General chemistry: Elements of inorganic and organic chemistry, including reduction of metals, properties of acids and salts, carburet of hydrogen, and dry distillation.

Mechanics: The various kinds of motion, with special reference to rotation; composition and resolution of forces; gravity, center of gravity; friction, friction of motion; equilibrium; elements of machinery; essentials of statics; the most important principles of hydrostatics and hydrodynamics.

Arrangement and management of workshops: Arrangement of shafting; mounting of wood-working machinery; efficiency and power of wood-working machinery.

Technology of wood: Explanation of the structure of wood; the value of wood, with reference to its technical industrial properties, impregnation, and conservation; discussion of tools and machines used in wood working and their essential qualities; general view of the important branches of the wood-working industry.

Technical finishing processes: Dressing, staining, rubbing, polishing, varnishing, japanning, gilding, etc.; consideration of the various auxiliaries; preparation and properties of glue, etc.

Industrial hygiene and prevention of accidents: Laws and regulations; instruction regarding the arrangement of working rooms; protective measures in the use of steam boilers, steam apparatus, and machinery, and in the erection of buildings; measures for prompt assistance in cases of accidents in factories.

Wood joining: Joinery work in general; the principles governing the correct application of the various kinds of wood joining; wood joining in house carpentry and cabinetmaking.

Workshop: The practical instruction embraces the various kinds of work found in cabinetmaking; the sharpening of tools, sawing in general, the planing of wood, the dressing of cross-grained wood, joining, gluing in general, grooving and tonguing, the cutting of grooves, dovetailing, ripping, mortising, doweling, veneering, furbishing, polishing of plane surfaces, molding, finishing and polishing of patterns; the cutting, dressing, and polishing of checkerwork; construction of entire objects from plain to more difficult subjects; joinery work, doors and windows.

By means of systematic methods in the workshop the instruction aims at thoroughness and that degree of manual skill which apprentices can attain only through a considerable expenditure of time. At the very beginning instruction is directed to the use of material and technical appliances with reference to the construction of useful objects, followed by the making of constructive details. Exactness in execution and precision is constantly insisted upon. The acquisition of the highest possible degree of speed in execution receives consideration later on. Nor is the student permitted to advance to a higher grade of the course until he has passed every lower grade satisfactorily.

The higher trade school for cabinetmaking and joining is intended (1) to give to cabinetmakers and joiners, who have learned their trade and have had considerable practical experience, such a higher technical training as will fit them for positions as foremen, superintendents, draftsmen, or managers of establishments; (2) to educate persons for the positions of foremen and technical instructors in trade schools for woodworking. Persons in order to be eligible for admission must be graduates of the lower grade intermediate schools (*Untergymnasium*, *Unterrealschule*, *Bürgerschule*), graduates of the lower trade school for cabinetmaking and joining, or they must produce evidence that they have learned and practiced the joiner's trade. Special pupils must be at least 18 years of age, must have learned their trade, and have had a thorough practice in the same. The course of instruction for regular pupils covers two years. Upon completing this course they receive graduation certificates. Special pupils receive certificates of attendance. The hours of instruction are from 8 a. m. to 12 m., from 2 to 6 p. m., and from 7 to 9 p. m. During the summer term pupils are occasionally taken on excursions to woodworking establishments.

The following statement shows the subjects taught and hours per week devoted to each in the higher trade school for cabinetmaking and joining for each of the two years of the full course:

First year: Descriptive geometry, 4; ornamental drawing, 2; trade drawing, cabinetmaking, 6; trade drawing, joinery work, 4; wood joining, winter term, 2; structure of the most important kinds of wood, total number of hours per year, 24; location, production, and technical properties of wood, total number of hours per year, 24; practical arithmetic, 1; industrial hygiene and prevention of accidents, winter term, 2; practical exercises in the workshop, winter term, 29; summer term, 33; practical exercises in turning, total number of hours per year, 48.

Second year: Trade drawing, cabinetmaking, 6; trade drawing, joinery work, 4; ornamental drawing, 2; chemical technology of wood, winter term, 2; technical finishing process, total number of hours per year, 48; arrangements and management of workshops, winter term, 1; mechanical technology of wood, winter term, 2; technology of auxiliaries, winter term, 2; wood joining, 2; practical arithmetic and correspondence, winter term, 2; practical exercises in the workshop, winter term, 29; summer term, 36.

Following is a synopsis of the foregoing course:

Descriptive geometry: Recapitulation of plane geometry and stereometry, projection, shadows, perspective.

Ornamental drawing: Sketching of ornaments, special drawing and designing of objects.

Structure of the most important kinds of wood: Explanation of the structure of wood; discussion of the characteristic features of the most important kinds of wood; practice in determining the various kinds of wood, with or without the aid of the microscope.

Origin, production, and technical properties of wood: Origin of the most important kinds of timber; examination of the quality and adaptability of standing timber for certain purposes; the cutting, transportation, and proper treatment of wood; examination of wood with reference to its technical and industrial qualities.

Chemical technology of wood: Discussion of the structure of wood from the chemical point of view; chemical properties of timber and the influence of chemical processes; impregnation, conservation; products which can be obtained from wood by chemical means.

Technical finishing processes: Discussion of the various technical finishing processes, as dressing, staining, polishing, varnishing, japanning, painting, gilding, etc.; consideration of the various auxiliaries; preparation and properties of glue, etc.

Arrangement and management of workshops: Arrangement of shafting, mounting of woodworking machinery, efficiency and power of woodworking machinery.

Mechanical technology of wood: Discussion of tools and machines employed in woodworking and their essential qualities, especially introduction of new mechanical apparatus and appliances.

Technology of auxiliaries: Discussion of the properties of the various auxiliary articles employed in woodworking, as cast iron, wrought iron, steel, bronze, tin, etc.; discussion of articles made of other material used in joining together the various parts of objects made of wood, as screws, nails, rivets, wire tacks, clasps, hinges, locks, latches, etc.; suggestions as to the proper use of these auxiliary articles; packing and transportation of the various products of the woodworking industry.

Wood joining: Wood joining in general; the principles governing the correct application of the various kinds of wood joining; suggestions regarding practical work in wood joining; wood joining in house carpentry and cabinetmaking.

Practical arithmetic: Computations in whole numbers, fractions, anquot parts, ratio and proportion, partnership, percentage, interest, square and cube roots, mensuration, cubical contents of timber; estimates of the various necessary supplies; computing selling price.

Practical exercises in the workshop: This subject embraces more difficult work by the students and general practice in technical work, with which they have so far been unfamiliar.

Practical exercises in turning: Instruction in this branch has for its aim the training of the student in the auxiliary trade of turning, in order to enable him to estimate correctly the various articles produced in this trade, in so far as it touches upon cabinetmaking.

The special course for the paper industry is intended to give young men an opportunity to obtain a theoretical education in paper making, wood-pulp grinding, and cellulose manufacturing. This school opens October 1 and closes March 31. Admission to this school is limited, and only those persons whose previous training has been such as to enable them properly to understand the subjects taught are admitted, preference being given to those who have had several years' experience in paper making. The matriculation fee is 4 crowns ($0.81), and the tuition for the entire course is 320 crowns ($64.96). All instruction, materials, and drawing utensils, except copies, models, and laboratory supplies, are paid for by the pupils. Occasional visits are made to paper mills and cellulose factories. In order to obtain graduation certificates, pupils must successfully pass examinations in all the branches taught. Persons taking this special course are at liberty to attend Sunday and evening courses at the museum, either in drawing, electro-technics, or other subjects.

The following statement shows the subjects taught and the hours per week devoted to each in the special course in paper making:

Technology of the manufacture of paper, 6; special drawing, 6; elements of machinery and machine drawing, 4; general chemistry, 2; knowledge of goods, 1; chemistry of paper making, 1; practice in microscopy, 2; motors and machine tools, 2; exercises in the chemical laboratory, 12; exercises in the testing institution for the examination of paper, 4; technology of bleaching materials, 2.

DEPARTMENT OF CHEMICAL INDUSTRIES.

This department of the museum is intended to fit persons having a preparatory knowledge of chemistry for practical work in the chemical industries by teaching the technology of chemistry, both theoretically and practically. The instruction is so specialized that each pupil, besides obtaining a general technical knowledge, is given a thorough education in the application of chemistry to the particular trade or calling which he intends to adopt. Special emphasis is given to the chemical operations of the textile industry. The department for chemical industries comprises a trade school for dyeing, a higher trade school for the chemical industries, and a school for tinctorial chemistry.

The lower trade school for dyeing has for its purpose the training of competent overseers or superintendents of dyeing establishments and master dyers. Candidates for admission must have the education required of graduates of the grammar or intermediate schools, and must pass an entrance examination. The school is in session from October 1 to July 31, and the full course covers three years.

The matriculation fee is 4 crowns ($0.81), and the tuition is 100 crowns ($20.30) per year. The tuition may be wholly or partly remitted in the case of worthy persons without means. All books and materials used in the theoretical work must be furnished at the expense of the pupils. A fee of 10 crowns ($2.03) per month the first year and of 20 crowns ($4.06) the second and third years is charged for the use of gas, water, steam, and chemicals in the laboratory. A deposit of 20 crowns ($4.06) the first year, 40 crowns ($8.12) the second year, and 60 crowns ($12.18) the third year is required to cover any possible damage to materials or apparatus. Examinations are held at the end of every half-year term, and pupils can not advance until they have passed them satisfactorily. Upon completing their three-years' course pupils receive certificates of graduation.

The following statement shows the subjects taught and the hours per week devoted to each:

First year: German language and business forms, 6; arithmetic, 4; physics, 4; inorganic chemistry, winter term, 4; organic chemistry, summer term, 4; practical exercises in the laboratory, summer term, 12; mineralogy, winter term, 1; geometrical and projective drawing, 6; free-hand drawing, 4; review of chemistry, 2.

Second year: Encyclopedia of chemical technology, 4; practical exercises in the laboratory, winter term 32, summer term 36; analytical chemistry, 2; mechanical technology, winter term, 3; study of goods and materials, winter term, 3; elements of machinery, summer term, 2; industrial bookkeeping, winter term, 2.

Third year: Special chemical technology, 4; technical analysis, 2; mechanical technology, winter term, 3; elements of machinery, winter term, 2; practical exercises in the laboratories, winter term 33, summer term 38.

Following is a synopsis of the foregoing course:

Physics: The most important elements of physics, with special reference to dyeing.

Inorganic chemistry: The most important elements and their combinations, with special reference to the chemicals used in the chemical industries.

Organic chemistry: The most important organic combinations, with reference to technics, especially to dyestuffs and dyeing materials.

Encyclopedia of chemical technology: Chemical technology of water, heating and heating materials, lighting; chemical industry; metals and metallic coloring substances; general survey of the more important sections of organic technology, etc.

Special chemical technology (dyeing and bleaching): Technology of fibrin; operations of bleaching; mordants and their uses; explanation of the processes of dyeing; the principal dyestuffs and their uses; composition of dyeing formulas; calculations.

Practical exercises in the laboratory: Qualitative tests of the most important bases and acids; simple technical tests in so far as they are necessary to the dyer.

Practical exercises in the dyeing laboratory: Dyeing with simple dyestuffs; experiments in bleaching; mordants and quantitative dyeing, experimental dyeing, dyeing from patterns, etc. (dyeing and bleaching of cotton, linen, hemp, jute, wool, silk, and mixed textiles).

Mechanical technology: The manufacture of textiles; a general survey of spinning and weaving.

Elements of machinery: Elementary principles, theory of steam boilers and steam apparatus, with reference to dyeing.

Study of materials and goods: A brief discussion of dyestuffs, sources of supply, and market quotations.

Geometric and projective drawing: Development of geometrical figures in plane geometry and stereometry.

Free-hand drawing: Instruction in this subject has for its aim the attainment of a certain degree of skill in drawing geometrical figures by free-hand; exercises in measuring by the eye and preparation for ornamental drawing. This object is attained by extending the elementary instruction received in the common school to drawing simple plane ornaments from copies in outlines and color and to a systematic course of drawing more difficult plane ornaments.

The higher trade school for the chemical industries is intended to give such a general education in chemistry and chemical technology as to prepare persons for positions as chemical experts in industrial establishments. The instruction is theoretical and practical, special attention being given to the particular line of work the pupil intends to follow. Candidates for admission as regular pupils must be graduates of intermediate schools or schools of a like grade. Others may be admitted as special pupils. The course covers two years. The school opens October 1 and closes July 31. Pupils are encouraged to work during their vacation in establishments where they can obtain practical experience in their chosen occupations.

The matriculation fee is 2 crowns ($0.41). The tuition is 100 crowns ($20.30) per year, and may be remitted in the case of persons of small means. A fee of 20 crowns ($4.06) per month is charged for laboratory work. All books or materials used for theoretical work must be

furnished by the pupils. A deposit of 40 crowns ($8.12) the first year and 60 crowns ($12.18) the second year must be made to insure against losses resulting from possible damage to materials, apparatus, etc. Examinations are held at the end of each half-year term, and these must be successfully passed by pupils in order to advance. Upon completing their full course pupils receive graduation certificates.

The instruction relates exclusively to technical subjects. The following statement shows the subjects taught and the hours per week devoted to each:

First year: Inorganic chemistry, winter term, 5; organic chemistry of sebaceous substances, summer term, 3; organic chemistry of aromatic compounds, summer term, 3; qualitative analysis, winter term, 2; quantitative analysis, summer term, 2; general pharmacology, winter term, 3; mechanical technology (spinning), winter term, 3; elements of machinery, summer term, 3; mineralogy, winter term, 2; practical exercises in the chemical laboratory, winter term, 24; summer term, 27; mathematics, 2; physics, winter term, 3; summer term, 2; mechanics, summer term, 2.

Second year: General chemical technology, 6; special chemical technology, 4; technical analysis, 2; mechanical technology (weaving), winter term, 3; elements of machinery, winter term, 2; practical exercises in the chemical laboratory, winter term, 25; summer term, 32; general mechanical technology, winter term, 2.

Following is a synopsis of the foregoing course:

General chemistry: A systematic study of the elementary substances and their compounds, with special reference to their technical application.

General chemical technology: A complete course in technology, involving the principal chemical processes. This course is so arranged that those branches which form the subject of special studies are treated more exhaustively, and in cases of several students pursuing the same special study separate lectures are given on these subjects.

Special chemical technology: The lectures in this course are arranged to suit the special studies of the students; but no separate lectures are given when only a few students pursue the same special course, special studies, in such cases, being pursued in connection with the laboratory work and under personal instruction.

Qualitative analysis: Analysis of inorganic compounds; analysis of important organic compounds.

Quantitative analysis: Simple quantitative determinations; methods of titration and compound quantitative analysis.

Technical analysis: Commercial value of raw and manufactured products, both organic and inorganic.

Pharmacology: A description of drugs, with special reference to the course under consideration, and their commercial values.

General mechanical technology: The working properties of metals, wood, and stone; brushing and separating, casting, hammering, pressing, rolling, and drawing; chiseling, sawing, turning, boring, polishing, etc.; work in combining (welding, soldering, riveting, etc.).

Mechanical technology of textiles: A general outline of the manufacture of textiles—spinning, weaving, and finishing. (These lectures are arranged to accommodate students of special subjects.)

Elements of machinery: Elementary principles, transmission, pumps, steam boilers, steam engines, water motors, presses, centrifugal machines, force pumps, digesting furnaces, machines for crushing, extracting apparatus, filtration, compressing machines, etc.

Mineralogy: Crystallography and systematic description of minerals.

Mathematics: Algebra through equations of the second degree with two unknown quantities and progression, geometry, trigonometry, elements of analytical geometry, differential and integral calculus.

Physics: A general course, embracing the elements of mechanics, heat, light, and electricity.

Practical exercises in the chemical laboratory: These exercises embrace analytic and synthetic work of a general and of a special character; in the latter case they are adapted entirely to the individual needs of the student. A thorough knowledge of qualitative and quantitative analysis forms the basis upon which the general and special technical analysis is further developed. The synthetic work is either of a general nature and is pursued parallel with the theoretical studies, or it relates to the special course of the student. In general the following course is pursued:

First year: Experiments in inorganic compounds and practice in the solution of chemical problems; quantitative analysis, with special attention to volumetric analysis; synthetic work; experiments in organic compounds, with practice in the most important typical reactions.

Second year: General and special consideration of the most important industrial products of organic and inorganic origin; special synthetic work; bleaching, dyeing, printing; production of organic dyestuffs, mordants, varnish, soaps, various preparations, etc.

Excursions to large manufacturing establishments whose productions are on the lines of this course of studies.

DEPARTMENT OF METAL INDUSTRIES.

This department is intended to educate pupils for practical work in the metal trades where iron and steel constitute the raw materials. It also serves to continue the education of those already engaged in one of the metal trades. There are, therefore, two schools—a lower and a higher school for iron and steel working. The pupils are either regular or special. The schools are in session from October 1 to July 31.

The matriculation fee is 4 crowns ($0.81). The tuition is 240 crowns ($48.72) per year, both for regular and special pupils, at either school. The tuition may be remitted in the case of pupils without means. In addition to the tuition a fee of 20 crowns ($4.06) per year is charged for wear and tear of tools and for the use of materials. All books and requisites for the theoretical work are furnished at the expense of the pupils. The products of the workshops belong to the museum.

The object of the lower trade school is the practical and theoretical training of persons for the housesmith's trade and for machine construction work (*Bau- und Maschinenschlosserei*). The instruction comprehends a complete training in the theory and skill requisite for these trades and thus replaces the regular apprenticeship. The course covers four years. Candidates for admission must be 14 years of age, must be graduates of the public schools, must be physically sound, and must pass an entrance examination. Pupils can not advance from one year's grade to another without passing a satisfactory examination. Upon successfully completing the full course they receive graduation certificates which, by virtue of a ministerial decree, entitle them to

practice their trades as master workmen. Each graduate is required to produce a masterpiece before receiving such a certificate. Special pupils receive certificates of attendance. The daily hours are from 8 a. m. to 12 m. and from 2 to 6 p. m. During the third and fourth years instruction is also given on certain days from 7 to 9 p. m. Occasional visits are made to manufacturing and other industrial establishments.

The following statement shows the subjects taught and the hours per week devoted to each:

First year: German language and business forms, 6; arithmetic, 4; free-hand drawing, 6; geometrical and projective drawing, 8; elements of physics and mechanics, 2; workshop, 18.

Second year: Arithmetic and elements of algebra, 4; free-hand drawing, 4; geometrical and projective drawing, 6; special drawing, 2; physics, 3; mechanics, 3; elements of machines, 4; mechanical technology of metals, 2; workshop, 16.

Third year: Mathematics, 4; descriptive geometry, 3; special technical drawing, 6; special industrial drawing, 3; general chemistry, 2; mechanical technology of metals, 3; elements of machinery, 3; industrial arithmetic, winter term, 2; bookkeeping, winter term, 2; workshop, 24.

Fourth year: Mathematics, winter term, 3, summer term, 2; special drawing, 10; building construction and drawing, 4; elements of machinery, 5; chemical technology of metals, winter term, 2; technical finishing processes, with practical work, winter term, 2; industrial hygiene and prevention of accidents, winter term, 2; special course for firemen and steam-engine tenders, summer term, 4; workshop, 24.

Following is a synopsis of the foregoing course:

German language and business forms: General exercises in oral and written expression and the most important forms of business letters.

Mathematics: Practical arithmetic, including proportion and percentage; fundamental principles of algebra, including equations of the second degree; elements of geometry, with demonstration of theorems, especially with reference to the theory of triangles, the square, and the circle; application of algebra to geometry and mechanics; application of trigonometry to problems in plane and volumetric measurements and in mechanics.

Free-hand drawing: Instruction in this subject has for its aim the attainment of a certain degree of skill in the drawing of geometric forms by free hand.

Geometrical and projective drawing: Students receive instruction in the principles of geometrical and projective drawing, especially the drawing of practical objects, with especial reference to their future work.

Descriptive geometry: The elements of descriptive geometry.

Technical trade drawing: Exercises in free-hand sketching and in drawing parts of machines which are treated of in connection with the subject of elements of machinery; drawing of machines from patterns and models, and drawing of machines from specifications with the aid of sketches, models, or patterns.

Industrial trade drawing: Drawing of ornamental trellis work and of all kinds of ornamental objects from sketches and patterns.

Physics and mechanics: The elements of physics; heat, acoustics, optics, statics, and dynamics.

Elements of machinery: Description of the various joints and fastenings used in machinery and the most important technical properties of metals; rivets, screws, wedges, pipes, faucets, valves, slides; shafts, axles, wheels, grooves; friction wheels, cogwheels, driving gear (belting, hemp, cotton, cable); gear for uncoupling; winches,

wheel and axle, cross bars and guide rods, steam engines, piston rods, piston-rod collars, fly wheels, beds for fly wheels, the mounting of motors, gearings and their mounting, pumps, force pumps, rotary pumps, centrifugal pumps, injectors and pulsometers; lifting gear—blocks and pulleys, windlass, reels, elevators, cranes; housesmith's work; principles of the steam engine, types of steam engines, valve motion, governors, equipment, running and taking care of steam engines. The students of the fourth-year class have practical work during the summer term at the boilers and the working machinery of the Technical Industrial Museum under the supervision and direction of the regular engineers.

Special summer course for firemen and steam-engine tenders: Steam and its properties, generating steam, fuel, combustion, stoking, the types of boilers; the embedding of boilers, the principles of boilers, armature, the tending of boilers, defects of boilers and their causes; principles of the steam engine, types of steam engines, gearing, equipment of the steam engine, the tending and care of steam engines.

Mechanical technology of metals: Consideration of the most important metals—cast iron, wrought iron, steel, copper, zinc, tin, lead, aluminum, gold, silver, platinum, and their alloys; tombac, brass, bronze, German silver, britannia metal, with reference to their properties and their action in the various methods of working them. Blacksmithing and cutting tools—hammers, anvils, punches, etc., chisels, turning and planing tools, scrapers, augers, drills, files, rasps, broaches. Tools for dividing, tracing, and measuring—rules, compasses, tools for tracing, templets, general and special tools for measuring angles. Blacksmithing—forges and bellows; explanation of the various operations of blacksmithing. Smelting, especially iron, and the furnaces used. Production of models with and without core; patterns. Casting—furnace, fire box, patterns, and fast molds. Soldering. The simple turning lathe and rose engine, with cross beams; turning tools; tools for making screws and nuts.

General chemistry: An elementary course in inorganic and organic chemistry.

Chemical technology of metals: Classification of metals, places where they are found, their production; explanation of the chemical processes in the production of the most important metals and their compounds.

Building construction and architectural drawing: The elements of building construction.

Workshop: The practical instruction embraces all the operations of the housesmith's trade and of machine construction work, including metal turning, practice in the use of machine tools; the making of tools for measuring and tracing, the casting of simple molds, and pattern making. In the workshop the students work under the immediate direction of experienced master workmen and foremen, and special attention is given to the thorough training of the student in the above-named branches as well as to their proper conduct. Special weight is given to exactness, neatness, and precision, the object in view being the acquisition of such skill and rapidity in the execution of their work as will qualify them to enter upon the practice of their trades.

The higher trade school for iron and steel work is intended to give graduates of the lower trade school and others having a similar training such further instruction and practice as will fit them to become managers, superintendents, or foremen. The pupils may be either regular or special. The course of study for regular pupils covers two years. Candidates for admission must have successfully passed through the grammar schools or schools of like grade (*Untergymnasium*, *Unterrealschule*, or *Bürgerschule*), and must be graduates of the lower trade school for iron and steel work or a school for electro-technics at the museum or a similar trade school, or they must give evidence that they

have learned their trade both theoretically and practically. Special pupils must be at least 18 years of age and have had a thorough experience as master workmen or journeymen. In order to be graduated, regular pupils must successfully pass examinations in all the obligatory branches taught. Upon completing their course pupils receive graduation certificates, which show not only the successful termination of each study, but also the previous experience and special qualifications of the pupils. Special pupils receive certificates of attendance.

The following statement shows the subjects taught and the hours per week devoted to each:

First year: Mathematics, 2; descriptive geometry, 2; mechanics, 2; machine construction, 2; trade drawing and drawing of machines, 6; building construction and drawing, 2; chemistry and physics, 2; mechanical technology, 2; chemical technology, winter term, 2; telegraphs, telephones, and electric clocks, winter term, 2; practical exercises in the workshop, 24.

Second year: Mathematics, 2; mechanics, 2; machine construction, 2; trade drawing and drawing of machines, 10; building construction and drawing, 2; mechanical technology, 2; magneto-electrical, dynamo-electrical machines, power transmission, gearing, lamps, winter term, 2; batteries and accumulators, electro-technical measurements, winter term, 2; technical finishing processes and galvanoplastics, winter term, 2; practical exercises in the workshop, 24.

Following is a synopsis of the foregoing course:

Mathematics: The course of the lower trade school in more expanded form, with special reference to trigonometry and stereometry, illustrated by numerous examples.

Descriptive geometry, including elements of projections and perspective.

Mechanics: The course of the lower trade school in more expanded form.

Machine construction: Wheels, belting, and all kinds of cable work, simple lifting machines, pulleys, cylinders, reels, elevators, cranes; steam-boiler construction; principles of boilers; capacity, safety valves, feeding apparatus, stoking, heating apparatus, hydrostatic-pressure tests, furnaces; principles of the steam engine; types of steam engines; principal parts, gearing, etc.; graphic description of simple centrifugal regulators; mounting, tending, etc.; pumps—the most important types (piston, rotary, and centrifugal), pulsometers, injectors; equipment of pumps, mounting and tending; hydraulic motors, gas motors, hot-air motors, petroleum motors.

Special drawing and drawing of machines: Object drawing illustrative of the lectures on the elements of machinery and technology; practical drawing of details from simple sketches or of entire objects.

Building construction and drawing: Constructions in iron, as skylights, conservatories, staircases, rafters; drawing of simple objects entering into the interior construction of buildings; plain dwelling houses; construction of factories and workshops.

Physics: Elements of magnetism and electricity.

Chemistry: Qualitative and quantitative determination of metals and metallic ores; alloys and compounds.

Mechanical technology of metals: Special metallurgy of iron; blacksmithing apparatus propelled by motors—levers, steam hammers, compressors; rolling and drawing; cutting and boring machines; shears; grinding and polishing; the principal properties of wood with reference to its adaptability to pattern making.

Practical exercises in the workshop: Working in metals by means of hand tools and machinery, mounting, adjusting, forging. Students take part also in instruction in pattern making.

The special course for boiler tenders and enginemen is intended to give to young men such a knowledge of boilers and engines, and of the laws governing the same, as is necessary to enable them intelligently to tend boilers and stationary steam engines. The courses are given from April 1 to July 31 of each year. Candidates for admission must be at least 17 years of age, and must show that they have had at least two years' shop experience.

The matriculation fee is 4 crowns ($0.81) and the tuition is 2 crowns ($0.41) per month. Persons attending the all-day classes at the museum may attend this course free of charge. Pupils completing this course receive certificates.

The course of instruction, which is given four hours per week, relates to steam and its properties and attributes, steam generating, the various kinds of fuels used, stoking, different types of boilers and boiler installations, fixtures, boiler tending, boiler defects and their causes, and the laws governing boiler inspection; the principles of the steam engine, types of engines, tending, regulating, and equipment of steam engines.

DEPARTMENT OF ELECTRO-TECHNICS.

This department comprises a higher and a lower trade school of electro-technics.

The lower trade school is intended to give such a theoretical and practical knowledge as will enable young men to become electrical workers and fitters and foremen in electrical establishments, light and power plants, etc. The pupils are either regular or special. The school is in session from October 1 to July 31.

The matriculation fee is 4 crowns ($0.81). The tuition is 240 crowns ($48.72) per year for regular and for special pupils. Students without means may be relieved from the payment of tuition after having attended at least one half-year term. A fee of 60 crowns ($12.18) per year is charged for the use of materials and the wear and tear of tools and apparatus. All books and requisites for the theoretical work must be furnished at the expense of pupils. Copies of models are furnished by the school. The products of the workshop belong to the museum.

The course of instruction covers three years. Candidates for admission as regular pupils must be at least 14 years of age, must have a grammar or intermediate school education, must pass an entrance examination, and upon being admitted must take up all the studies mentioned in the programme. Special pupils must be 18 years of age and must have the necessary preparatory education. In order to advance from one class to another a satisfactory examination must be passed. Each person successfully completing the three-year course receives a graduation certificate, which specifies the length of time of attendance and the qualifications of the graduate. This certificate

entitles the holder to the independent practice of his trade. Special pupils receive certificates of attendance. The school is in session from 8 a. m. to 12 m. and from 2 to 6 p. m. Occasional visits are made to establishments and electrical plants.

The following statement shows the studies and the hours per week devoted to each:

Preparatory: German language, 4; geography and history, 3; arithmetic, 4; free-hand drawing, 4; geometric and projective drawing, 8; elements of physics and mechanics, 3; workshop, 18.

First year: German language, 4; geography, 3; arithmetic and elementary algebra, 4; geometric and projective drawing, 6; physics, 3; mechanics, 3; elements of machines, 4; special drawing, 2; mechanical technology of metals, 2; workshop, winter term, 12, summer term, 15.

Second year: German language, 3; geography and history, 3; mathematics, 4; general chemistry, 2; elements of machines, 3; special drawing, 6; mechanical technology of metals, 3; physics, 4; telegraphy and telephones, 2; workshop, 16.

Third year: German language, 2; geography and history, 3; mathematics, 2; special drawing, 6; elements of dynamo machinery, 2; technics of lighting, 2; theory of measurements and instruments with exercises, 8; galvanoplastics, 2; signals, 1; workshop, winter term, 16, summer term, 20.

Following is a synopsis of the foregoing course:

German language: Practical exercises in the German language, including grammar, composition, and rhetoric; reading and analysis of masterpieces selected from German literature.

Geography and history: A general course in descriptive, mathematical, and physical geography; ancient, mediæval, and modern history.

Mathematics: A complete course in practical arithmetic; elements of algebra, including equations of the second degree; plane geometry and trigonometry, with their application to measurements of surfaces and volume and to problems in mechanics.

Free-hand drawing: Instruction in this subject aims at the attainment of a certain degree of skill in the drawing of geometric figures by free hand.

Geometric and projective drawing: Students receive instruction in the principles of geometric and projective drawing, with special reference to their future work.

Elements of physics and mechanics: Elementary properties of bodies; mechanics of solids, fluids, and gases; elements of acoustics and optics; statics and dynamics.

Elements of machines: Description of the various joints and fastenings and the most important technical properties of metals; rivets, screws, wedges, pipes, faucets, valves, slides, shafts, axles, wheels, grooves; friction wheels, cogwheels, driving gear (belting, hemp, cotton, cable); gear for coupling and uncoupling; all details of the steam engine.

Special drawing: Exercises in free-hand sketching and in drawing parts of machines which are treated of in connection with the subject of elements of machinery and electro-technics; drawing of machines from patterns and models, and from specifications with the aid of sketches, models, or patterns.

Mechanical technology of metals: Consideration of the most important metals—cast iron, wrought iron, steel, copper, zinc, tin, lead, aluminum, gold, silver, platinum, and their alloys; tombac, brass, bronze, German silver, britannia metal, with reference to their properties and their action in the various methods of working in them. Blacksmith tools and cutting tools—hammers, anvils, punches, etc., chisels, turning and planing tools, scrapers, augers, drills, files, rasps, broaches. Tools for dividing, tracing, and measuring—rules, compasses, tools for tracing, templets, general and special tools for measuring angles. Blacksmithing—forges and bellows;

explanation of the various operations of blacksmithing. Smelting, especially iron, and the furnaces used. Production of models with and without core; patterns. Casting—furnace, fire box, patterns, and fast molds. Soldering. The simple turning lathe and rose engine, with crossbeams; turning tools; tools for making screws and nuts.

General chemistry: Elements of inorganic and organic chemistry.

Physics: Magnetism, magnets, magnetic force, poles, magnetic axis, attraction and repulsion, magnetic influence, magnetizing, temporary and permanent magnets, terrestrial magnetism, declination, inclination, horizontal components and their determination, magnetometer; electricity—frictional electricity, transmission of electricity, positive and negative electricity, electroscope, electrical influence, theory of electricity, laws of electric action, density, tension, electrophorus, electrical machine, induction, condensers, effects of frictional electricity, velocity of electricity, atmospheric electricity; galvanic electricity; fundamental test, tension, force, capacity, Volta's theory, the galvanic current, electrolysis, polarization, galvanic elements, accumulators, effects of a current, galvanometers, Ohm's law, deduction, absolute and practical unit, currents, electro-magnetism, effect of magnets upon currents, induction (magnetic, voltaic) batteries; thermo-electricity; the principal elements.

Telegraphy and telephones: Construction of plants; general discussion of the materials used in construction; protective appliances for telegraphs and telephones against storms. Electro-magnetic transmission—the Morse system, with its main and accessory apparatus, polarized apparatus, relays, systems of duplex telegraphy; apparatus for submarine lines; Hughes's telegraphic printing system; the automatic systems; authographic telegraphs; house, market, and fire-alarm telegraphs; telephone and microphone systems, methods of disposition, equipment of central stations; interurban telephones; telegraphic clock regulators.

Dynamos, transformers, power plants: Direct-current machines, armature, magnetic field, reaction of currents, theory of electro-magnetic engines, theory of series dynamos, characteristics, currents; theory of compound machines; field magnets, description of special types; alternating-current machines, generating alternating currents, motors; transformers; transformation of direct and alternating currents, elementary theory, discussion of special types.

Technics of lighting: Surface and underground transmissions; branches and connections; construction, insulation; computing and testing transmissions; electric lamps, arc and incandescent; conduits.

Theory of measurements and instruments, with practical exercises: General and special observations, carriage, mirror readings; segment and tangent needles; galvanometer; electro-dynamometer, voltameter, electrometer, calorimeter, rheostat; methods and apparatus for measuring resistance, efficiency, temperature coefficient; methods and apparatus for measuring the current and determining eletromotor force; photometer (method of measuring, the necessary instruments). The object of the practical work is to familiarize the student thoroughly with the practical use of the instruments. He is required to perform the work and measurements in which he has received theoretical instruction, in order to give him that degree of skill and reliance which he needs in his future work. The practical exercises, therefore, embrace work which has reference to the measurement of resistance, efficiency, capacity, force of currents, and tension, to measurements of incandescent and arc lamps, and to dynamos.

Signal systems and lightning rods: Signal and control apparatus for special purposes, with special reference to railways; consideration of lightning rods, their construction; other appliances for protection against lightning; test of lightning conductors.

Galvanoplastics: The plating of metals and their alloys; preliminary and finishing operations; the most common methods of plating metals; processes of refining.

The higher trade school of electro-technics is intended to give such skill and technical knowledge as will fit persons for all branches of practical electrical work and at the same time give such a higher technical training as will enable them to occupy important positions in electrical establishments. The pupils are either regular or special. The school opens October 1 and closes July 31.

The matriculation fee is 4 crowns ($0.81), and the tuition is 240 crowns ($48.72) per year for both regular and special pupils. In the case of pupils without means the tuition may be remitted. A fee of 10 crowns ($2.03) is charged for laboratory work. The pupils must pay for all books and materials used in the theoretical work. The products of the shops belong to the museum.

The regular course of instruction covers two years. Candidates for admission must be graduates of the lower trade school of electro-technics or must have passed through at least six grades in an intermediate school, or if they are graduates of a lower intermediate school, they must have passed through two grades of a higher State industrial school. Special pupils must be at least 18 years of age. Examinations in all branches must be successfully passed in order to advance from one grade to another. Pupils receive certificates setting forth the successful completion of each of the studies and the previous experience and special qualifications. The final examinations are regulated by the ministry of education. The school is in session from 8 a. m. to 12 m. and from 2 to 6 p. m. Occasional visits are made to establishments and electric plants.

The following statement shows the branches taught and the hours per week devoted to each:

First year: German language, 2; geography and history, 2; elements of higher mathematics, 2; physics, 4; elements of machinery, 2; electro-technics, 3; general chemistry, winter term, 3; summer term, 2; special drawing, 8; workshop and laboratory, winter term, 22; summer term, 21.

Second year: German language, 1; geography and history, winter term, 2; summer term, 1; mathematics, winter term, 3; summer term, 2; electro-technics, 3; chemistry, 2; special drawing, 8; elements of machinery, 1; workshop and laboratory, 24.

Following is a synopsis of the foregoing course:

German language: Selections from German literature, with exercises based upon these selections.

Geography and history: Modern history and geography of Europe, with special reference to lines of transportation.

Mathematics: Elements of higher mathematics, including logarithms, binomial formulæ, analytical geometry, differential and integral calculus.

Physics: Review of the most important sections of mechanics, with special reference to statics, theory of heat, especially mechanical heat; optics; exhaustive treatment of magnetism and electricity.

Elements of machinery: Estimates of plants; encyclopedic treatment of lifting gear and pumps; steam boilers; steam engines.

Electro-technics: Multi-polar direct-current generators, measurements; direct-current motors; power transmission; insulating measurements for cables; determining errors; theory of alternating currents.

General chemistry: The elements of inorganic chemistry.

Special drawing: Exercises in drawing and sketching various apparatus and instruments.

COURSES FOR MASTER WORKMEN.

These courses are open only to master workmen and to journeymen who have already acquired a certain degree of skill in their respective trades. Model workshops, with corresponding courses, were open during the school year 1899–1900 for shoemakers, joiners, tailors, housesmiths, and carpenters. To be admitted to these courses, applicants must have attained the age of 24 years and must not be over 45 years old. They must present satisfactory recommendations and must have satisfied all military requirements. In selecting applicants to these courses preference is given in the first place to masters and in the second place to journeymen who intend shortly to practice their trade as masters, or who are members of a trade association or similar organization or can produce evidence that they will shortly become members of such an organization. The hours of instruction are from 8 a. m. to 12 m. and from 2 to 7 p. m.

The entrance fee to all courses is uniformly 4 crowns ($0.81), payable in advance.

The number of persons attending these courses is limited to 18 in the course for shoemakers; to 15 in the courses for joiners, tailors, and carpenters; and to 12 in the course for housesmiths.

Following are the courses in detail:

Course for shoemakers: There are from 4 to 6 of these courses a year, each course continuing six weeks. The following subjects are taught: Taking measurements, trade drawing, cutting, hand work on uppers and bottoms; the use of the most important modern machines employed in shoemaking; industrial bookkeeping and computations; elements of law. Tuition is 50 crowns ($10.15), payable in advance. Persons without means may, upon proper application, have their tuition remitted and may receive pecuniary assistance. For residents of Vienna the pecuniary assistance for masters amounts to 120 crowns ($24.36), and for journeymen 100 crowns ($20.30); for nonresidents it amounts to 180 crowns ($36.54) for masters and 140 crowns ($28.42) for journeymen, with reimbursement of their railroad fare for third-class passage. Persons who thus receive pecuniary assistance are exempt from the payment of tuition, but in no case is there an exemption from the payment of the entrance fee.

Course for joiners: There are several of these courses each year, each course continuing eight weeks. Systematic instruction is given in the following subjects: Trade drawing (windows, doors, portals, etc.); shopwork; the making of windows, doors, etc., from detail drawings in natural size, by means of modern tools and especially modern machinery; estimates; technology of auxiliary articles, as clasps, etc.; tools and woodworking machines; industrial bookkeeping and computations; elements of law. The tuition for this course is 80 crowns ($16.24). Persons without means may, upon proper application, as in the case of the course for shoemakers, have their tuition remitted and may receive pecuniary assistance. For residents of Vienna the pecuniary assistance for masters amounts to 160 crowns ($32.48) and for journeymen 140 crowns ($28.42). For nonresidents it amounts to 240 crowns ($48.72) for

masters and 190 crowns ($38.57) for journeymen, with reimbursement of their railroad fare for third-class passage. Persons who thus receive pecuniary assistance are exempt from the payment of tuition.

Course for tailors: There are from 4 to 6 of these courses each year, each course continuing six weeks. Systematic instruction is given in the following subjects: Taking measurements; trade drawing; designing patterns; cutting; the making of model pieces; industrial bookkeeping and computation; elements of law. The conditions as to tuition, pecuniary assistance, etc., prevailing in the course for shoemakers are also applicable to this course.

Course for housesmiths: There are several of these courses each year, each course continuing eight weeks. Systematic instruction is given in the following subjects: Special drawing of the most important articles pertaining to the housesmith's trade, as locks, clasps, etc.; lectures on trade drawing; shopwork; instruction in the making of various articles pertaining to this trade, with special reference to the treatment of various metals, selection of tools, use of the most important machine tools, etc.; technology—the most important materials, their properties and their manufacture; housesmith's tools and metal-working machines, machines and motors; description of the construction and the use of small motors, repair of locomobiles and agricultural machines; industrial hygiene and prevention of accidents; industrial bookkeeping; practical arithmetic; elements of law. The same conditions as to tuition, pecuniary assistance, etc., which prevail in the course for joiners are also applicable to this course.

Course for carpenters: This course is intended to educate a class of competent foremen, and, owing to its more extensive subject-matter as compared with the other courses for master workmen, its duration has been extended to twelve weeks. The course of instruction embraces geometrical drawing, roofing, building construction, technology, practical arithmetic, practical work in carpentry, elements of law. Tuition in this course is free. The stipends for those who are residents of Vienna are uniformly 200 crowns ($40.60), and for nonresidents 240 crowns ($48.72).

SPECIAL EVENING AND SUNDAY COURSES.

These courses are intended for men who are engaged in practical work, and they are so arranged as to offer the greatest scope of instruction possible in order to suit the special needs of each individual. The courses are open from the beginning of October until the end of March. Applicants for admission must have attained the age of 17 years. The entrance fee is 4 crowns ($0.81), payable in advance. Tuition for the term is 12 crowns ($2.44), which in certain cases may be paid in installments. There is no exemption from the payment of these fees. Each person has the choice of the lectures and exercises, but no change from one course to another is permitted after the opening of the lectures. Certificates covering the subjects pursued are issued only to those who apply for them at the beginning of the term, who are regular in their attendance, and who pass the required examination at the close of the lectures or exercises.

The following is a synopsis of the various subjects of instruction:

DRAWING.

1. Geometrical and projective drawing, two hours per week. Elementary exercises in geometrical and projective drawing, shadows, and network.

2. Trade drawing for joiners, four hours per week. Drawing from copies on various scales; remodeling from copies; detail drawing from copies and sketches.

3. Technical drawing for housesmiths and machinists, four hours per week. Exercises in drawing from copies with due regard to the previous knowledge of the student.

4. Industrial drawing for housesmiths and other metal workers, two hours per week. Exercises in drawing and sketching of various articles produced in the metal trades.

TECHNOLOGICAL LECTURES.

1. Location, production, and technical properties of wood, two hours per week. The location of the most important kinds of timber in Austria; examination of the quality and properties of standing timber for certain purposes; cutting, transportation, and proper treatment of wood; examination of wood with reference to its technical and industrial properties.

2. Structure of the most important kinds of timber, two hours per week. The cellular structure of timber; the arrangement of cells; the concentric layers; difference between the older and newer concentric layers; characteristics of the most important kinds of timber.

3. Chemical technology of timber, two hours per week. Examination of the structure of timber from a chemical point of view; phenomena of a chemical nature in timber and effect of chemical processes upon the same; impregnation; preservation; products obtained from timber by chemical processes.

4. Technical finishing processes of wood with practical exercises, four hours per week. Dressing, staining, polishing, varnishing, japanning, gilding, etc.; examination of the various auxiliaries; preparation and properties of glue, etc.

5. Chemistry of food, two hours per week. Meat, meat products, preserved meat, milk, butter, cheese, honey, flour, table oil, coffee, substitutes for coffee, wine, beer, brandy, and other spirituous liquors, water.

6. Technology of bleaching material, two hours per week. Chlorine, binoxide, manganate of potash, sulphuric acid, sulphite of soda, hydrosulphurous acid, hydrosulphite of soda, properties of these and other bleaching materials.

7. Motors and machine tools, two hours per week. Historical, theory of the steam engine, gearing of steam engines, machine tools for metal working, turning lathes, planing and shaping machines, boring machines, grinding machines, mortising machines, friezing tools and presses.

8. Chemical technology of metals, two hours per week. Location, chemical properties, special characteristics of metals; production of metals; influence of impurities; influence of carbon in iron; precious and base metals; their oxides; compounds.

9. Technical finishing processes of metals with practical exercises, two hours per week. The plating of metals and their alloys; the most common methods of plating metals; finishing processes; grinding, scouring, staining, calcining, etc.

10. Industrial hygiene and prevention of accidents, two hours per week. The proper arrangement of workshops, protective measures against accidents in factories, etc.

ELECTRO-TECHNICS.

1. Elements of electricity and magnetism, two hours per week. Magnetism; frictional, galvanic, and thermo electricity.

2. Telegraphs, telephones, and electric clocks, two hours per week. The open current, the Morse system, the closed current, submarine telegraphy, dial telegraph, telephones, microphones, electric clocks.

3. Electrical machines and transformers, two hours per week. Induction, direct current machines, alternating current machines, transformers.

4. Transmission of power, lamps, plants, two hours per week. Theory of transmission of power, the different systems, construction of arc lamps, incandescent lamps, construction and estimates of plants.

5. Batteries and accumulators, electrical measurements, two hours per week. Units of measure, galvanic and thermo elements; accumulators; the most important systems; measuring instruments; methods of measuring resistance, current, and tension; photometry; practical exercises on Sunday mornings for a limited number of students on the determination of resistance, the force of currents, tension, intensity of light, etc.

OTHER SUBJECTS.

1. Mathematics, six hours per week. Practical arithmetic, including square and cube roots, elementary algebra, and plane geometry.

2. Bookkeeping and correspondence, two hours per week. Single-entry bookkeeping and industrial correspondence, including the principal legal forms, as contracts, documents, etc.

3. Chemistry of the perfumery industry, one hour per week. Chemistry of perfumes, description of natural and artificial perfumes, methods of producing artificial perfumes, technology.

4. Stenography, two hours per week. A course in stenography with exercises in reading and writing stenographic correspondence. Tuition for this course is 6 crowns ($1.22).

SCHOOLS FOR IMPORTANT GROUPS OF TRADES.

These institutions are usually known as "industrial schools" (*Gewerbeschulen*). Of the twenty schools enumerated in the introduction the State schools at Reichenberg and Innspruck have been selected for detailed description, because in the scope of their work and character of their organization they are fairly representative of the entire class.

STATE INDUSTRIAL SCHOOL AT REICHENBERG.

This school (*k. k. Staats-Gewerbeschule*), which comes within the class of schools for important groups of trades, was founded in 1875. Its object is to train persons for important positions in industrial establishments and for handicraft trades, in accordance with the needs of modern industry. The aim of the school is, among other things, to advance domestic industry to a position of independence of foreign markets. The institution consists of two divisions, a higher industrial school (*höhere Gewerbeschule*) and a school for foremen (*Werkmeisterschule*). The former includes a department for the building trades, a department for the mechanical trades, and a department for the chemical industries. The school for foremen comprises a department for the building trades and one for mechanical industries. An industrial continuation school is also conducted in connection with this institution.

The higher industrial school aims to give, by means of systematic instruction, all the necessary technical knowledge required in the practical operation of factories or handicraft trades, and at the same

time to give a certain degree of general education whereby persons may become competent to carry on higher technical trades or to occupy important positions in manufacturing establishments. Thus, the department for building trades is intended to educate architects, building contractors, and foremen of stonecutters, carpenters, etc. The mechanical-technical department is intended for future manufacturers, superintendents of factories, and technical experts in machinery construction work, metal working, wood working, electro-technics, spinning and weaving mills, etc. The chemical-technical department is intended for manufacturers, superintendents, and technical experts in the various chemical industries, such as dyeing, textile printing, bleaching, sugar refining, distilling, brewing, glass and pottery works, chemical works, etc. For students desiring to devote themselves to the textile industries a special course in the theory and practice of weaving is provided. There is a special laboratory for students taking the course in electro-technics, and a mechanical workshop for those taking the mechanical-technical course. Graduates may continue to work in these shops in order to devote themselves exclusively to practical work for one or two half-year terms. For the chemical branches of the textile industry there is a dyeing school and a laboratory.

The course of study in each department covers four years. Candidates for admission must be at least 14 years of age, must be graduates of three-grade grammar schools (*dreiclassige Bürgerschulen*) or of institutions of a similar rank and must pass an entrance examination in arithmetic, geometry, and natural philosophy. The final examinations prior to graduating cover the whole course of the school. The school term begins September 16, each year. The tuition is 8 florins ($3.25) per half-year term. The regular students in the chemical-technical department pay, in addition, 15 florins ($6.09), and the special students 25 florins ($10.15), per half-year term for the use of the laboratory. Persons without means may be granted free scholarships.

Following is the programme of the subjects taught in the higher industrial school and the hours per week devoted to each:

MECHANICAL-TECHNICAL DEPARTMENT.

First year: German language, 5; geography, 3; algebra, 5; geometry, 4; geometrical drawing, 4; physics, 4; chemistry, 3; free-hand drawing, 6.

Second year: German language, 3; geography and history, 3; mathematics, first term, 10; second term, 6; descriptive geometry, first term, 9; second term, 7; physics, 4; chemistry, 4; mechanics, second term, 4; free-hand drawing, first term, 6; second term, 4; machine drawing, second term, 4.

Third year: German language, 3; geography and history, 3; mathematics, first term, 5; second term, 2; mechanics, first term, 4; second term, 7; machine construction, 16; general mechanical technology, 6; chemical technology, 2; mensuration, second term, 2.

Fourth year: German language, 2; geography and history, 3; theoretical and applied mechanics, first term, 8; second term, 7; machine construction, first term, 7; second

term 8; machine drawing, 13; elements of machinery, first term, 4; general mechanical technology, second term, 4; elements of architecture and architectural drawing, 2; special mechanical technology, 4.

Following is a synopsis of the foregoing course:

The course in drawing embraces exercises in free-hand drawing and sketching parts of machines and entire simple machines, perspective drawing of machine models, and machine drawing with lectures on the elements of machines and their construction.

Machine construction: Elements of machines, construction of pulleys, windlasses, cranes, presses, pumps, water wheels, turbine wheels, steam boilers, steam, caloric, and gas engines, steam-engine gearing. Electro-technics—dynamos, measuring instruments, lamps, and plants; measurements of currents, resistance and tension, with practical illustrations; simultaneous measurements of electrical power of dynamos and of electric lamps.

General mechanical technology: Technology of metals and of wood with special reference to their use in machinery; drawing and sketching of tools, machinery, and factory equipments; principles of spinning, weaving, finishing, and paper making.

Chemical technology: Technology of fuel, water, lighting; scouring, bleaching, dyeing, and printing; distilling, brewing, and sugar refining.

Mensuration: Arrangement and use of the most important measuring and leveling instruments.

Theoretical and applied mechanics: Mechanics of power-transmitting machines and motors, hydraulics, theory of water motors, of pumps and ventilators; theory of mechanical heat with reference to steam and gas; theory of steam and caloric engines; electro-mechanics based upon experimental physics with special reference to electric lighting and transmission of power.

Machine drawing: Drawing of connected parts of machines, reproduction of machines, drawing of machines from sketches or from simple designs.

Elements of machines: Machines, their construction, efficiency, required power, and their work, their arrangement and proper gearing.

Elements of architecture and architectural drawing: Elements of building construction with special reference to the wants of the students.

Special mechanical technology (for students who intend to take up the textile or paper industry): Spinning and weaving with special reference to the construction of the machines pertaining thereto; finishing machines; paper making; drawing and sketching from samples and reproduction of working machines pertaining to the textile industry.

BUILDING-TRADES DEPARTMENT.

First year: Indentical with the first year of the mechanical-technical department.

Second year: German language, 3; history and geography, 3; mathematics, first term, 10; second term, 6; descriptive geometry, first term, 9; second term, 7; physics, 4; chemistry, 4; elements of architecture, second term, 6; free-hand drawing, 6.

Third year: German language, 3; history and geography, 3; building construction, 15; architectural mechanics, 4; architectural styles, 6; chemical technology, 2; free-hand drawing, 6.

Fourth year: German language, 2; history and geography, 3; building construction, first term, 24; second term, 20; architectural styles, 2; architectural mechanics, 2; mensuration, second term, 4; free-hand drawing, 6. Optional—stonecutting, second term, 3.

Following is a synopsis of the foregoing course:

Free-hand drawing: This course embraces exercises in free-hand drawing from plastic models, especially the ornamental styles used in the various architectural branches; designing, with special reference to architectural ornaments and decorations; exercises in pen drawing.

Building construction: Consideration of the various building materials; excavation, foundation, masonry work, carpenter's work, housesmith's work, painting, paperhanging, etc.; heating and ventilation; water, telephone, and gas connections; closets and sinks; the different types of the most common buildings in city and country; remarks on location, size, and connection of rooms; building hygiene and protective measures; estimates and building contracts; building regulations; exercises in drawing plans for agricultural and industrial buildings and dwelling houses.

Architectural mechanics: Composition and resolution of forces; gravity; stability; their application to architecture; principles of mechanics; theory of lifting machines, etc.

Architectural styles: The various orders, attic, doric, etc.; moldings and casings in general; base moldings, breast moldings, etc.; profiles of door and window casings; arrangement of façades; the various styles of architecture with reference to ornamental and constructive details; the oriental style; systems of Greek and Roman architecture and their most important monuments; Byzantine and Mohammedan style; Romanesque and Gothic architecture; studies in Italian renaissance and that of other countries; architecture of the eighteenth and nineteenth centuries.

Chemical technology: Technology of fuel, water, glass, clay; principles of distilling, brewing, and sugar refining.

CHEMICAL-TECHNICAL DEPARTMENT.

First year: Identical with the first year of the mechanical-technical department.

Second year: German language, 3; history and geography, 3; mathematics, first term, 6; second term, 4; descriptive geometry, 3; physics, 4; chemistry, first term, 8; chemical laboratory work, second term, 6; mechanics, second term, 4; mineralogy and geognosy, 3; free-hand drawing, first term, 6; second term, 4.

Third year: German language, 3; history and geography, 3; general chemistry, 4; technical chemistry and chemical technology, first term, 3; second term, 5; chemical laboratory work, 20; mechanics, 2; elements of machinery, 3.

Fourth year: German language, 2; history and geography, 3; technical chemistry and chemical technology, 6; chemical laboratory work, 22; elements of machinery, 3; mechanical technology, 3; building construction and drawing, 2.

Following is a synopsis of the foregoing course:

Chemical laboratory work: Setting up of simple apparatus; practice in chemical operations; simple analysis by dry methods; reactions; simple analysis by wet methods; lectures on analytical chemistry with practice in qualitative analysis; preparation of chemicals; exercises in quantitative determinations, with special reference to the technical-analytical work of the student in his specialty.

Mechanics: Composition and resolution of forces; gravity, friction, and resistance; simple machines; stability; the essentials of physics with reference to the needs of the chemist; geodynamics; equilibrium and motion of fluids and gases with special reference to technical chemistry.

Mineralogy and geognosy: Studies of the most important minerals, their crystallographic, physical, and chemical properties; elements of geognosy.

Free-hand drawing: Exercises in reproducing and sketching parts of machines, chemical apparatus, and of machines from models and drawings; exercises in colors.

Technical chemistry and chemical technology: Examination and filtration of water; manufacture of various chemical products, metalloids, acids, salts, combustibles, and gunpowder; technology of lime, gypsum, and cement; manufacture of glass and earthenware, etc.; fuel and heating; lighting and lighting material; organic dyestuffs, dyeing, printing, and bleaching; industries connected with agriculture; fat and soap industry; tanning; excursions to factories and workshops for purposes of observation.

Elements of machinery: Description and construction of the most important parts of machines, calculating machines, and measuring instruments; the use of motors; measurement of water power; description and explanation of vertical and horizontal water wheels, pumps; ventilators, presses; application of steam power, production of steam; description and explanation of steam engines; electric lighting.

Mechanical technology: Technology of metals and of wood; spinning, weaving, and paper making.

Building construction and drawing: Elements of architecture with reference to the future work of the student.

Optional studies: Modeling in clay, work in gypsum, wood, and stone, three hours; bookkeeping and business correspondence, two hours; fire department, its organization and service, two hours; relief measures in cases of accidents, ten hours; laws and regulations governing trade and commerce, two hours.

SPECIAL COURSE IN THEORETICAL AND PRACTICAL WEAVING.

[Arranged for students who intend to devote themselves to the textile industry.]

Theory of weaving: The three classes of fabric formations; weaving of cotton, worsted, and woolen fabrics; formation of the outer and inner weave; calculations for the heddles; separation of simple cotton, wool, and mixed fabrics; double weaving; fancy goods; calculations for yarn.

Handloom weaving: Work on Jacquard looms; tying up; counting and punching cards.

Theory of mechanical weaving: Principles of power looms; formation of fabrics; mechanism of looms. Instruction in this subject is in connection with the subject on special mechanical technology.

Practice in mechanical weaving: Weaving on various power looms; mounting the same and taking them apart; putting together of cards according to the class of fabrics.

The school for foremen is intended to give to persons already engaged in the building trades, or in some branch of practical mechanical work, an opportunity to obtain, in the shortest possible time, such skill and theoretical knowledge as is of greatest value to a master workman or foreman in an industrial establishment. The school comprises two divisions: A building trades department for master masons, builders, architectural draftsmen, carpenters, stonecutters, joiners, tinsmiths, roofers, plasterers, etc.; and a department for mechanical trades, such as machinists, locksmiths, machine builders, instrument makers, blacksmiths, boiler makers, coppersmiths, millwrights, overseers in weaving mills, master spinners, sizers, etc. This school is especially suited for young men who wish to succeed their fathers in the management of their own mechanical establishments, such as machinery construction, locksmithing, weaving, spinning, sizing, etc., or the building trades.

Each division consists of four half-year courses, which in the building trades department are given only during the winter term and thus extend over a period of four years. This enables the students of the latter department to practice their trade during the building season of each year.

Candidates for admission must have completed their common-school education and must show that they have practiced their trade at least two years. Persons who have not completed the second grade of a grammar school (*Bürgerschule*) must attend a two years' course in an industrial continuation school before being admitted. The school term begins September 16 in the department for mechanical trades and October 15 in the department for the building trades. The tuition is 6 florins ($2.44) per half-year term. A fee of 10 florins ($4.06) per half-year term is charged for the use of the workshop. Pupils without means may receive free scholarships.

Graduates of the building-trades department are given an opportunity to enter the State railway service of Austria as minor officials. Upon entering the railway service they receive a salary of 1.25 florins ($0.51) per day each and the uniform of assistant road overseer (*Aushilfs-Bahnmeister*). After a period of probation advancement is made to the position of road overseer (*Bahnmeister*), with a yearly salary of 500 florins ($203) and free residence.

Following is a programme of the subjects taught and the hours per week devoted to each:

BUILDING-TRADES DEPARTMENT.

First term: German language, 4; geography, 1; arithmetic, 6; geometry, 5; projections, 8; physics, 4; free-hand drawing, 8; building construction, 4.

Second term: German language, 3; business correspondence, 1; geometry, 4; projections, 8; physics, 2; building construction, 13; architectural styles, 2; free-hand drawing, 8.

Third term: German language, 2; business correspondence and bookkeeping, 2; mensuration, 2; algebra, 4; building construction, 15; architectural styles, 6; free-hand drawing, 8. Optional: Modeling in clay, work in gypsum, wood, and stone, 3; fire extinguishing, 2.

Fourth term: Mechanics, 4; building construction, 4; designing, 21; free-hand drawing, 10. Optional: Stonecutting, 3; fire department, its organization and service, 2; relief measures in cases of accident, 10.

Following is a synopsis of the foregoing course:

The course in free-hand drawing embraces exercises from plain designs to the representation of plastic ornaments, exercises in coloring surface ornamentation, drawing from models, especially those relating to architecture, exercises in sketching, working drawings for builders from models, drawings of façade details in natural size, by the use of samples and models.

Building construction: Stone and frame work, vaults, staircases, ceilings, floors, plastering, roofs and roofing, building materials, carpenter work, house and locksmith work, glazier work, painting, heating and ventilation, closets and sinks, wells, foundation, iron construction, plans for urban and rural buildings, estimates, building regulations, building hygiene and protective measures.

Architectural styles: Profiles of casings, their representation on a large scale, the various orders, with special reference to the Roman style, arrangement of casings, windows, and doors.

Mensuration: The most important measuring and leveling instruments, practical exercises in laying out and platting building lots and buildings.

Designing of rural and urban buildings from various plans.

MECHANICAL-TRADES DEPARTMENT.

First term: German language, 4; geography, 1; arithmetic, 6; geometry, 5; projections, 8; free-hand drawing, 8; physics, 4; mechanical technology, 4.

Second term: German language, 2; business correspondence, 1; algebra, 4; geometry, 4; physics, 4; elements of machinery, 5; free-hand drawing, 6; projections, 7; machine drawing, 6.

Third term: German language, 2; business correspondence and bookkeeping, 2; mathematics, 4; physics, 4; mechanics, 6; elements of machinery, 3; machine drawing, 14; mechanical technology, 4; special mechanical technology, 4.

Fourth term: Mechanics, 8; elements of machinery, 7; machine drawing, 16; building construction, 2; special mechanical technology, 4.

Following is a synopsis of the foregoing course:

Elements of machinery: Cranes and elevators; pumps and ventilators; stoking, boilers, steam engines, and how to tend them; water motors; motors for small establishments; thorough knowledge of the construction and the relative speed of machine tools, their power and their efficiency; [illegible] for electrical measurements, lamps, and electric plants. Also special lectures on the construction of mills, breweries, distilleries, waterworks, etc., according to the special needs of the students.

Mechanical drawing: Drawing of the different parts of machines, from samples and models, and from rules; reproduction of entire machines.

Mechanical technology: Principles of spinning, weaving, bleaching, paper making.

Special mechanical technology: (In classes who intend to take up the textile industry.) Spinning and weaving with reference to the construction of the machines pertaining thereto, bleaching machines, paper making, drawing and sketching from samples and reproduction of existing machines pertaining to the textile industry.

Building construction: Building materials, foundations, building operations, plastering, and leveling.

Optical and [illegible]: Practical exercises in mechanical working; [illegible] grinding department, its organization and service, relief lenses, use of models.

The continuation school offers opportunities for handicraftsmen of all trades to extend their technical training in the evenings and on Sunday mornings. Special attention is given to instruction in drawing and modeling, which is gradually specialized for the particular trade followed by the student. The instruction given at the school comprises: geometry, geometrical drawing, and the study of projections, seven hours per week; drawing for the building trades, seven hours; drawing for the metal trades, seven hours; free-hand and industrial art drawing, seven hours; modeling, four hours. Instruction is given on three week days from 6.30 to 8.30 p. m. and on Sundays from 6 a. m. to 12 m. In addition to these, special courses are given in bookkeeping and accounting, two hours per week; estimating cost of production of joinery work, two hours per week, for journeymen; architectural styles, two hours per week, for joiners, stonecutters, etc.; mechanics, two hours per week, for machinists, turners, instrument makers, etc., and a course for boiler and engine tenders, two hours per week. Each course lasts seven months, from October 1 to May 1. At the close of each course pupils receive certificates of scholarship, attendance, and deportment. The tuition is 2 florins (80.41) per course.

The attendance of the day courses at the Reichenberg industrial school was as follows at the beginning of the school term 1898–99:

Higher industrial school: First year, 90; second year, 77; third year, 78; fourth year, 75; total, 320. Of these, 90 were in the preparatory class, 57 in the department for the building trades, 98 in the mechanical-technical department, and 75 in the chemical-technical department.

School for foremen: Building trades department—first year, 48; second year, 40; third year, 38; fourth year, 39; total, 165. Mechanical trades department—68 pupils, of whom 62 took the mechanical and 6 the chemical trade course.

At the close of the school term 1897–98 there were 72 graduates from the higher industrial school, 30 from the building trades department and 29 from the mechanical trades department of the school for foremen.

The following table shows the number and occupations of persons attending the regular courses of the industrial continuation classes attached to the school at the beginning of the school term 1898–99:

NUMBER AND OCCUPATIONS OF PERSONS ATTENDING THE CONTINUATION CLASSES OF THE STATE INDUSTRIAL SCHOOL AT REICHENBERG, 1898-99.

Occupations.	Attendance.		Occupations.	Attendance.	
	Masters and journeymen.	Apprentices.		Masters and journeymen.	Apprentices.
Locksmiths	2	9	Bookbinders		1
Masons	5	19	Piano and organ makers		1
Slate roofers		1	Dyers		2
Tinners	4		Goldsmiths		1
Stonecutters	2		Wood carvers		1
Carpenters	6	2	Tailors	1	
Finishers		1	Lithographers		9
Electricians	1	1	Cabinetmakers	10	12
Molders		1	Photographers	1	1
Brass workers	1	1	Compositors		2
Machinists	2	33	Ornamental and decorative painters	4	2
Mechanics	1	2	Others	2	
Metal turners		4			
Spinners	1	1	Total	52	114
Wire-drawers		1			
Sculptors	9	6			

STATE INDUSTRIAL SCHOOL AT INNSPRUCK.

This institution (*k. k. Staats-Gewerbeschule*) comes within the same class as the preceding, except that it does not include a higher industrial school, but is only a school for foremen. It comprises a department for the building trades and one for industrial art.

The department for the building trades includes: (1) A school for builders, with two full-year and three half-year winter terms, intended for draftsmen, master builders, etc.; (2) a school for carpenters, with two full-year and one half-year winter terms; (3) a school for stonecutters, with two full-year and one half-year winter terms; (4) a school

for joiners, with a four years' course, including practical training in workshops; (5) a school for lock, house, and tin smiths, with a two years' course.

The department for industrial art comprises: (1) A trade school for the woodworking industry, with a four years' course, including a workshop for cabinetmaking, turning, inlaid work, and wood carving; (2) a trade school for metal work, with a four years' course, including a workshop for brass and bronze work, gold and silver smithing, engraving, chasing, electroplating, and fancy wrought-iron work; (3) a trade school for painting and decorating, with a two and one-half years' course, intended for decorators, glass stainers, sign painters, majolica decorators, lithographers, xylographers, retouchers, mosaic workers, etc.

In addition to these, there are four special courses given at this institution, namely: (1) A course for makers of instruments of precision; (2) a drawing course for girls; (3) an industrial continuation school; (4) an open drawing hall for men, where instruction is given on Sunday mornings.

Candidates for admission to the first-year classes must have completed their regular common-school education. Those taking the industrial continuation course must, in addition, be actually serving as apprentices or journeymen. The drawing hall is open only to masters and journeymen.

The matriculation fee is 1 gulden ($0.41) and the tuition is 3 gulden ($1.22) per half-year term in the building trades and industrial art departments, 2 gulden ($0.81) in the special course for makers of instruments of precision and the drawing course for girls, and 1 gulden ($0.41) in the industrial continuation school, no matriculation fee being charged in the latter. No tuition is charged for attendance at the open drawing hall. Free scholarships are granted to persons of small means.

Following is a programme of the branches taught at this institution and the hours per week devoted to each:

BUILDING-TRADES DEPARTMENT.[a]

First year: Religion, 2; German language, winter term, 5; summer term, 2; geography, winter term, 3; arithmetic, winter term, 4; summer term, 3; geometry, winter term, 5; summer term, 2; geometrical drawing, winter term, 9; free-hand drawing, winter term, 10; summer term, 12; penmanship, winter term, 3; summer term, 2; business correspondence, summer term, 2; projections, lectures and drawing, summer term, 12.

Second year: German language, winter term, 2; physics, winter term, 4; algebra, in schools for builders and carpenters only, winter term, 3; summer term, 2; projections, winter term, lectures, 2; drawing, 6; architecture, winter term, 3; summer term

[a] The branches taught are pursued in common by all students of the schools embraced in this department, unless otherwise stated.

in schools for builders and carpenters, 3; in schools for stonecutters, joiners, and house and tin smiths, 2; architectural drawing, winter term in schools for builders and carpenters, 9; in schools for stonecutters, joiners, and house and tin smiths, 12; summer term, in schools for builders and carpenters, 9; in school for stonecutters, 12; in schools for joiners and house and tin smiths, 16; free-hand drawing, winter term, 8; summer term, 10, except in school for stonecutters, 9; business correspondence and bookkeeping, summer term, 3; projections and linear perspective, summer term, lectures 1, drawing 4; ornamental styles, summer term, 4; modeling, summer term, in school for stonecutters, 4.

Third year (winter half-year term): Graphical statics, in schools for builders and carpenters, 2; building materials, in schools for builders and carpenters, 2; architecture, in schools for builders and carpenters, 3; architectural drawing, in schools for builders and carpenters, 15; in school for stonecutters, 16; free-hand drawing, in schools for builders and carpenters, 10; in school for stonecutters, 14; modeling in school for stonecutters, 4.

Fourth year (winter half-year term): Architectural styles, 2; architectural drawing, in schools for builders and stonecutters, 10; in school for carpenters, 8; architectural mechanics, in schools for builders and carpenters, 3; architecture, in school for builders, 4; architectural drawing in school for builders, based upon the lectures on the preceding subject, 11; business relations of the builder, in schools for builders and carpenters, 1; rural architecture, in schools for builders and carpenters, 2; viatecture, in school for carpenters, 6; drafting in school for carpenters, 11; in school for stonecutters, 16; free-hand drawing, in schools for builders and carpenters, 6; modeling in school for stonecutters, 11.

Fifth year (winter half-year term), school for builders only: Surveying, 3; viatecture, 6; drafting, 20; general history of art, 2; free-hand drawing, 8. Optional—modeling, 6.

Following is a synopsis of the branches especially pertaining to the building trades:

Architecture (all schools): Architectural styles, kinds of masonry, stone bonds for walls, round and polygonal pillars, construction of chimneys, basements, and walls; framing, framing timber, etc., iron bonds, construction of masonry, fastening pins and their applications.

Schools for builders and carpenters: Natural and artificial foundations, piling, concrete work, theory and bearing strength of such foundations; sheet piling, dikes, truss frames, construction of ceilings and floors from wood, construction of ceilings from wood and iron, block walls, framed partitions, rough brickwork, construction of roofs, truss work for small and large spans, dome and tower roofs, framing, joining of rafters, covering of roofs, construction of roofs from wood and iron, construction of casings, plain scaffolding for arches with small and large spans, construction of wells, inclosures.

School for stonecutters: Natural building stone, with special regard to the local conditions of Tyrol and the Vorarlberg; mortars; stonecutters' tools; stone quarrying, dressing stones, working drawings; cut of stones for basements and casings, freestone masonry, arches, and vaults; cut-stone ribs in Gothic vaults, their projection and setting; stone walls between doors and windows, Gothic carved work; projection and estimates of staircases, forms of stairs and stone railings.

School for joiners: Characteristics of the various kinds of wood used by joiners; construction of the various kinds of doors, windows, gates, sliding doors, air tubes, window blinds, shutters, flooring, wainscot work, wooden ceilings.

School for house and tin smiths: Production and properties of iron; the various kinds of iron used in commerce; the various kinds of tin and its production; tinsmiths' and housesmiths' tools; fastening pins, rivets, tie bands, and screws; tin roofing, eaves, pipes, water spouts, gabled dormer windows; construction of locks, door and window fastenings; windows of fancy iron, screens, lightning rods, and tower caps.

School for builders only (fourth year): Arches and vaults and their representation in building plans; barrel, intersecting, cloister, and domed vaults, their scaffolding, construction in layers with regard to the cut of stone; production of brick; the Prussian cellar vault and the surbased spherical vault; the vaulting between traverse and girdles, oblique barrel vaults; house and street drainage, the use of hollow tiles; estimates of the cubical contents of all kinds of vaults; estimates for the various kinds of wooden, stone, and iron staircases; construction of windows, doors, gates, furnaces, ranges, stoves, and chimneys; theory of steam heating, ventilation, plans for kitchens, cellars, dining rooms, and laundry rooms; plans for water-closets, sinks, ice pits, baking ovens, embedding of steam boilers, chimneys, iron supporters, and columns; construction of balconies and projectures.

Architectural drawing (all schools): Drawing of plain building details from samples; drawing of wood and stone bindings from samples and models; exercises in construction; sketching in colors; exercises in drawing architectural forms from nature. Generally, the students draw the objects which pertain to their particular line of work. The exercises in drawing are based mainly upon the lectures on architecture, and follow the methods used in the Government architect's office. Special attention is given to the detail working drawings, particularly in the schools for joiners, housesmiths, and tinsmiths.

Schools for builders, carpenters, and stonecutters: Drawing of the antique orders and of the renaissance, their details on a larger scale; drawing of base moldings, separating moldings and capital moldings of the Roman and renaissance periods in outlines and representing the cuts in colors; natural details of casing profiles with reference to the ornamental; drawing of portions of façades from correct types of the renaissance and particularizing them in natural size. The stonecutters also draw details of the Gothic style, tombstones, chimneys, simple wells, and the various forms of lettering most commonly used in stone masonry. The carpenters draw only the Tuscan and Doric orders after Vignola, details of frame buildings, verandas, and details in natural size.

Free-hand drawing: Drawing of architectural moldings with plastic ornaments, basreliefs, acanthus, capitals, rosettes, etc., from plaster casts. The stonecutters also draw ornaments for filling in, brackets, etc., foliaceous ornaments of the Gothic style, and profiles of all kinds of molding. The carpenters draw also carved beam heads, vertical uprights, etc. The housesmiths draw mainly details of smiths' work, ornamental railing, mountings, and locks of various kinds. The tinsmiths draw ornamental motives on balcony brackets, casings, etc. Pencil and rubber, water colors, quills and pens are mainly employed in drawing.

Modeling: Modeling from simple plastic samples in clay; exercises in more complicated ornamental motives from models, and finally of sculptuary details from drawings in natural size.

Building materials: Stratification of rocks, natural building stones, their classification, production, and use, with special reference to local conditions; artificial building stones and their production; brick, brickkilns, beton stones; lime, Portland cement, limekilns and cement mills, gypsum, mortar, hydraulic mortar, cement mortar; building timber, the cutting of timber, characteristics of sound timber, classification and use of timber in building construction; the various metals employed in building construction and their production; other materials, as glass, paints, varnish, etc.

Architectural forms: Classification of the various orders, modules; the various orders of the Grecian, Roman, and renaissance periods, the Tuscan order, the Doric, Ionian, and Corinthian orders of the Greeks; Italian masters of the sixteenth century. In considering the Roman orders and those of the renaissance period, attention is given to the changes which took place in the detail forms of the Greek period. Of the orders of the renaissance period, those of Vignola are chiefly considered. The Tuscan order of the renaissance, being of the most importance to the builder,

receives special attention. Exterior of buildings—the foundation and division of walls; windows and doors, arcades, halls, balconies, projectures, dormer windows, roofs, formation of façades and their composition; remarks on the influence of the construction and the position of the building in regard to its architectural style.

Architectural mechanics: Theory of vaulting and retaining walls; estimates of simple iron constructions with regard to their bearing strength; transporting machines.

Business relations of the builder: Building regulations for cities and the country, their meaning and influence upon construction and exterior style of buildings, building plans, scales of building plans, sketches, designs, detail plans, estimates, methods of calculating the various kinds of builders' work; essentials of bookkeeping, builders' contracts, builders' journal, weekly rolls, bills, receipts, statements; examination of the building ground, marking out, leveling; work and obligations of the architect, the master mason, the foreman, and the clerk of the architect's office.

Rural architecture: Construction and plans of the most important agricultural buildings, with exercises in drawing as outlined under drafting.

Drafting: The carpenters draw from plans and in detail complex props and supports of roofs, frame and block houses, scantling work, etc., with special reference to rural architecture. The ornamental details are drawn in natural size in connection with free-hand drawing. Statements and estimates are made of one of these objects. The stonecutters draw window and portal frames, tombstones, simple wells, etc., and represent the natural details according to the methods in use in architecture. School for builders only—Lectures on the general principles governing the drafting of buildings; drafting plain city dwellings, country houses, and agricultural buildings; exercises in making plans and estimates.

Surveying: Explanation of the most common surveying instruments; elements of surveying, laying out building lots, measuring altitudes, leveling, drawing profiles of elevations, exercises in platting, and practice in surveying.

Viatecture in connection with exercises in drawing: Laying out streets, longitudinal and cross profiles, construction of streets; construction of plain bridges from wood and stone; construction of sewers, embankments, dikes, and locks.

General history of art: A general survey, with practical illustrations of prominent monuments of art, and with special reference to the monuments of the renaissance.

INDUSTRIAL-ART DEPARTMENT.

Schools for wood and metal work.

First year: Religion, 2; German language, winter term, 5; geography, winter term, 3; arithmetic, winter term, 4; summer term, 3; geometry, winter term, 5; geometrical drawing, winter term, 9; free-hand drawing, winter term, 10; summer term, 6; penmanship, winter term, 3; German language and business correspondence, summer term, 4; shopwork, summer term, 43.

Second year: German language, winter term, 2; physics, winter term, 4; projections and drawing, winter term, 8; summer term, 6; free-hand drawing for joiners and turners, winter term, 4; special drawing for wood carvers and metal workers, winter term, 4; modeling for wood carvers and metal workers, 4; geometry, summer term, 2; architectural forms, summer term, 1; architectural drawing, summer term, 4; wax molding for wood carvers and metal workers, summer term, 4; shopwork, winter term, 36 and 32, respectively; summer term, 45 and 41, respectively.

Third year: Ornamental forms, winter term, 4; estimates, winter term, 1; technology of wood, 1; technology of metals, 1; modeling for wood carvers and metal workers, winter term, 4; summer term, 6; wax molding for carvers and metal workers, winter term, 4; summer term, 6; special drawing for joiners and turners, 10; special drawing for wood carvers and metal workers, 6; shopwork, winter term, 38; summer term, 47 and 45, respectively.

Fourth year: Practical bookkeeping, winter term, 2; ornamental forms, winter term, 4; trade drawing, 10 and 6; modeling, for wood carvers and metal workers, 6; wax molding, for wood carvers and metal workers, 6; elements of surface anatomy, for wood carvers and metal workers, summer term, 2; general history of art, summer term, 2; shopwork, winter term, 38 and 36, respectively; summer term, 46 and 42, respectively.

Following is a synopsis of the branches pertaining to the schools for wood and metal work:

The subject of technology of wood embraces the following: General properties, production, and treatment of timber; classification of timber; the various processes employed in wood working; tools and implements for mounting and securing; measuring and marking; splitting and cutting tools; joining, mediums for joining, staining, polishing, japanning; hand and steam power machines employed in wood working.

Technology of metals: Classification, properties, and use of the most important metals employed in industrial art, their location and production. Production of alloys, their properties and uses, especially of bronze, gold and silver alloys, and the production of niello.

Shopwork: Instruction in the workshop begins with exercises in the use of material and the handling of tools without regard to complete objects; this is followed by practice in the construction of detail parts of objects and of entire objects of the simplest nature. Each step of the work must be satisfactorily completed by the student before he advances to the next higher grade. The construction of complete objects of various kinds in the wood industry and in artistic metal work completes the course of instruction in shopwork.

The objects made by the students may become their property by paying for the material used, or they may be acquired by the board of directors by compensating the students for their labor.

School for painting and decorating.

First year: Religion, 2; German language, winter term, 5, summer term, 2; geography, winter term, 3; arithmetic, winter term, 4, summer term, 3; geometry, winter term, 5, summer term, 2; geometrical drawing, winter term, 9; free-hand drawing, winter term, 10, summer term, 12; penmanship, winter term, 3; business correspondence, summer term, 2; projections and drawing, summer term, 8; physics, summer term, 4.

Second year: German language, winter term, 2; bookkeeping, winter term, 2; projections and drawing, winter term, 7; ornamental forms, winter term, 4; free-hand drawing, winter term, 10, summer term, 9; trade drawing, winter term, 10; elements of anatomy, summer term, 2; industrial art drawing and decorative painting, summer term, 18; architectural forms, summer term, 9.

Third year, winter term: Business calculations, 1; industrial art forms, 4; general history of art, 2; free-hand drawing, 10; industrial art drawing and decorative painting, 22.

Business calculations embrace exercises in computing the purchase price from given conditions; computing the selling price; calculating the selling prices of goods with reference to interest rates, depreciation of plant, costs of management, net profits desired, etc.; arranging and compiling estimates of cost.

Industrial art forms in connection with exercises in sketching: Explanation of technical forms and art forms; influence of the material on form; application of structural symbols to industrial art forms; general principles of surface decoration on buildings and objects of industrial art (ceiling and wall decoration, façade painting, glass staining, majolica decorating); sketching in outlines; simple shading or sketching in colors the objects treated of in the lectures.

COURSE FOR MAKERS OF INSTRUMENTS OF PRECISION.

The special course for makers of instruments of precision is intended to give such theoretical knowledge and skill in drawing as are important and necessary to the practical workman in this industry. Applicants for admission to this course must have completed the studies of the first three half-year terms at the State industrial school as outlined in the following programme, or they must produce satisfactory evidence of having pursued such studies elsewhere.

Following is the programme of the preparatory half-year term courses:

First and second terms: The studies of the first and second half-year terms correspond with the first year of the department for building trades, except that architecture and architectural drawing are omitted, their places being supplanted by an increase of hours in geometry and theory of projections.

Third term: German language and business correspondence, 2; bookkeeping, 2; algebra and plane trigonometry, 4; graphic statics, 2; theory of projections, lectures, 2; drawing, 10; technology of metals, 4; free-hand and trade drawing, 12.

The special course which follows the preparatory course, as outlined above, continues for ten months, with twelve hours' instruction per week, of which two hours are devoted to lectures and ten hours to drawing. Lectures are given on measuring instruments, on apparatus for electro-technics, on the component parts of watches, etc. Drawing from samples and models based upon the lectures. During the remaining hours of the day the students are occupied in practical work in the mechanical workshops of Innspruck.

DRAWING COURSE FOR GIRLS.

This course embraces the following subjects: Elementary drawing (geometrical and free-hand); textile drawing (for embroidery, fancy work, etc.); decorative and majolica painting (painting in water colors, painting on wood, silk; painting in enamel on crockeryware and porcelain); free-hand drawing (figural and ornamental drawing from samples and plastic models).

Students who at the beginning are not sufficiently advanced in drawing receive, first, instruction in elementary drawing and gradually advance to textile drawing and painting according to their proficiency. It is recommended that students attend this course for at least two years.

INDUSTRIAL CONTINUATION SCHOOL.

Instruction in the industrial continuation school is limited almost entirely to exercises in drawing and modeling. An opportunity is thus given to young persons who have already entered upon a trade and are therefore unable to attend the regular courses of the State Industrial School to acquire a manual skill in drawing and modeling which is so necessary in the practical work of most industrial branches.

The school is divided into two classes: (1) The preparatory class, extending through one year; (2) the advanced class, extending through at least two years.

The first class admits students who have had very little or no previous instruction in drawing.

The second class admits students who have passed the first year's course satisfactorily or who can show that they have already taken a course in elementary drawing.

Following is the programme of the subjects taught in this school and the number of hours per week devoted to each:

Preparatory class: Elementary drawing (geometrical and free-hand), 6; penmanship and business correspondence, 2; practical arithmetic, 2.

Advanced class: Technical drawing, 4; free-hand drawing, 4.

Instruction in modeling is given only to students of the advanced class of this school and is limited to those whose occupation urgently requires a knowledge of this subject. The students have alternately one week exercises in drawing and one week exercises in modeling.

OPEN DRAWING HALL FOR MEN.

This drawing hall, which is open on all Sundays and holidays from 9 a. m. to 12 m. free of tuition, is intended to afford masters and journeymen who are so situated as to be unable to attend any of the other courses of the State industrial school the opportunity to cultivate taste and style in drawing. Instruction in elementary drawing, and in the copying and designing of industrial subjects, is given by proficient teachers.

An opportunity is also given to the graduates of the State industrial school, under the guidance of their former teachers, to further improve themselves in their specialties, and by means of the accessories of the institution to solve problems met with in their practice.

A branch of the State industrial school at Innspruck is the trade school for wood carving and cabinetmaking at Hall, Tyrol.

The object of the trade school at Hall is mainly the training of competent wood carvers. At the same time it is a practical preparatory school for those who intend to devote themselves to the cabinetmaker's trade.

The school includes: (1) A workshop for wood carving and cabinetmaking, with a course in elementary and technical drawing and modeling, practical arithmetic, business correspondence, and bookkeeping; (2) a Sunday and holiday course in elementary and special drawing; (3) a course in drawing for pupils of the public schools.

The workshop, with its course in drawing and modeling, is open to young persons who have at least satisfied the common school requirements.

The Sunday and holiday course is open only to those who have already entered upon a trade.

Students are admitted to the school at the beginning of October and March each year.

The hours of instruction in the workshop, including drawing and modeling, during the winter term, are from 8 to 11 a. m. and from 1 to 6 p. m.; during the summer term, from 7 to 11 a. m. and from 1 to 6 p. m. On Sundays and holidays the hours of instruction are from 9 a. m. to 12 m.

The following statement shows the attendance at each of the departments of the State industrial school at Innspruck and the branch school at Hall, for the school term 1898–99:

ATTENDANCE AT STATE INDUSTRIAL SCHOOL AT INNSPRUCK AND BRANCH TRADE SCHOOL AT HALL, 1898–99.

Departments.	Regular pupils.		Special pupils.
	Winter term.	Summer term.	
State industrial school at Innspruck:			
Building trades department	84	41	.....
Industrial art department	46	44	.....
Course for makers of instruments of precision	4	a 4	.....
Drawing course for girls	19	a 21	.....
Industrial continuation school	117	a 117	.....
Open drawing hall for men	35	40	.....
Branch trade school at Hall:			
Trade school for wood carving and cabinetmaking	32	30	4
Sunday and holiday drawing classes	.....	.....	32
Drawing classes for pupils of the public schools	.....	.....	21
Total	337	297	57

a Attendance during the summer term is optional.

SCHOOLS FOR PARTICULAR TRADES.

The schools for particular trades comprise the most numerous class of industrial schools in Austria. According to an official enumeration there were 96 State schools and 62 private and State subsidized schools of this class in Austria in 1899. Of this number 37 State schools have been selected for individual description. These are grouped in accordance with the classification given in the introduction, namely: (1) Schools for lace work and embroidery; (2) schools for weaving; (3) schools for wood, iron, and stone work; (4) schools for earthenware and glasswork; (5) schools for metal working; (6) schools for other trades.

Schools for Lace Work and Embroidery.

STATE SCHOOL FOR MACHINE EMBROIDERY, DORNBIRN.

The object of this school is to give the necessary theoretical and practical training for successfully carrying on the machine embroidery trade. The instruction embraces five embroidery courses of two months each, five courses in pattern embroidery work of two months each, and nine courses in art embroidery of one month each for special pupils. The subjects taught include machine embroidery, pattern designing, pattern embroidery, restoring, cutting, and preparing embroidery goods, embroidery work on tulle and other goods, openwork, gold and silk embroidery, and art embroidery on sewing machines. Following is a synopsis of the courses of instruction:

Embroidery courses: Study of machinery used in embroidery work, such as embroidery and crocheting machines worked by treadles; hand embroidery; study of materials used for ground work in embroidery, their necessary qualities, and their uses on embroidery machines; bleaching and finishing; study of yarns used in

embroidery, including qualities and processes of various kinds of yarns or threads, and the particular materials used in special kinds of embroidery work; instruction in the various styles of embroidery, such as hand embroidery, chain-stitching machine embroidery, etc., and in the use of embroidery machines; practical study of the quality and value of the finished products of embroidery work; pattern drawing and enlarging.

The school is under the management of a board consisting of the mayor of Dornbirn and 5 associates. The teaching personnel consists of the director and a number of assistants.

The school year begins October 1 and ends July 30. During the school term 1897-98 an evening course was also held at the school.

For the regular courses a tuition fee of 1.50 florins ($0.61) per course of two months is charged. A tuition fee of 5 florins ($2.03) per month is charged for the special embroidery courses. Provision is made for free scholarships for needy and industrious pupils. The school received a subsidy of 400 florins ($162) from the provincial council (*Landesausschuss*), and donations for stipends and scholarships were received from other sources.

During the school term 1897–98 there were 28 pupils taking the embroidery course, 51 the pattern embroidery course, and 16 the art embroidery course.

STATE SCHOOL FOR HAND AND MACHINE EMBROIDERY, GRASLITZ.

This school embraces the following divisions and courses: (1) An embroidery trade school, which has for its purpose the theoretical and practical training of workers on embroidery machines; (2) a pattern embroidery course, which covers instruction in pattern embroidery, mending, and restoring; (3) a division for open-work embroidery and (4) a special course in art embroidery. Under normal conditions pupils can complete the first and second courses in three months. The time required for completing the third and fourth courses depends upon the aptitude of individual pupils.

The theoretical instruction embraces general educational, technical, and industrial art branches, drawing, sketching, pattern drawing, and designing. The technical instruction comprises the study of embroidery machines and the technical properties of the goods, yarns, etc., used in embroidery work. In the practical instruction, on which the greatest stress is laid and to which the most time is devoted, pupils are systematically instructed along all lines of their future work, and the greatest value is attached to accuracy. In these trade courses the pupils are given an opportunity to gain a knowledge of all the branches of embroidery work and to master its difficulties.

Candidates for admission must be 14 years of age and must have graduated from the common schools. The tuition is 1 florin ($0.41) for the course, and a matriculation fee of 50 kreutzers ($0.20) is charged.

Foreign pupils must pay a tuition fee of 10 florins ($4.06) and are admitted only by permission of the ministry of education. Instruction is given on Wednesdays from 2 to 5 p. m. from October 1 to July 15.

The school is under the management of a board, consisting of the mayor of Graslitz and 4 associates. There are 3 instructors, a principal, and 2 trade teachers. The school received a subsidy of 200 florins ($81.20) from the ministry of education for the year 1898.

During the school year 1899–1900, 22 pupils attended this school, of whom 18 were regular and 4 were special pupils. All attended the day courses. The school does not undertake to provide good positions for all graduates. They generally find employment as embroiderers, and under favorable circumstances advance to become master workers or overseers.

STATE SCHOOL FOR EMBROIDERY AND LACE MAKING, LAYBACH.

This school is organized into three departments: Embroidery, lace making or sewing, and lace crocheting. Tuition is free, materials also being furnished gratuitously. This school gives instruction in artistic work that can not well be obtained in the ordinary workshops or the homes of the working classes. Instruction is thus given in decorating, designing, embroidery materials, styles, etc. Pupils may be either regular or special.

The programme of instruction includes elementary and technical drawing, cutting out designs, and transferring designs from patterns to goods to be embroidered, thirty-four to thirty-eight hours per week; German and Slavonic languages, arithmetic, bookkeeping, and business forms, thirty-four to thirty-eight hours per week. The practical work varies according to the department. The course in embroidery covers three years, practical instruction being given twenty-three hours each week during the first and second years and thirty hours during the third year. The course in lace making or sewing likewise covers three years, twenty hours being devoted each week to practical work during the first and second years and twenty-six hours during the third year. The course in lace crocheting covers two years, twenty hours per week being devoted to practical work the first year and twenty-two hours per week the second year. The work includes every technical feature of embroidery, lace sewing, and lace crocheting.

The attendance during the school term 1899–1900 was 93 pupils, of whom 49 were regular day pupils, 8 were special pupils in the day courses, and 36 attended other classes.

Schools for Weaving.

STATE SCHOOL FOR WEAVING, REICHENBERG.

This institution contains a day trade school with a two years' course, an industrial continuation school, and a workshop for power-loom

weaving. The day school comprises an all-day trade course, including four weeks of practical preparatory work, and a special course for students of the State Industrial School at Reichenberg (see pp. 475 to 482). The object of this day school is to give such systematic, theoretical, and practical instruction in all branches of the weaving industry as will fit graduates to fill positions as manufacturers, overseers, master weavers, draftsmen, and other positions in weaving establishments. The school also serves to educate young persons who wish to fill mercantile positions in which a knowledge of textile fabrics is necessary.

The complete instruction covers two years. During this period only a general foundation in all the branches taught can be given, the pupils being allowed an additional half or whole year in which to specialize for their chosen vocations. The theoretical instruction embraces technical, commercial, mathematical, and general educational branches. Special attention is given to the technical work, to drawing, and to practice in the workshop. Following is a statement of the subjects taught and the hours per week devoted to each:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, STATE SCHOOL FOR WEAVING, REICHENBERG.

Subjects taught.	Hours per week.	
	First year.	Second year.
Theory of textiles	4	2
Analysis of textile fabrics and cost of production	5	7
Technology of hand-loom weaving	2	½
Technology of power-loom weaving	.....	4
Technology of spinning	1	1
Sizing and finishing	.....	½
Machinery	2	1
Mechanical drawing	.....	2
Descriptive geometry and drawing	3	.....
Free-hand and pattern drawing	6	4
Pattern designing	4	4
Practical weaving on hand looms	9	8
Practical weaving on power looms	.....	8
German language	2	.....
Industrial arithmetic and business forms	4	.....
Industrial bookkeeping	.....	2
Total	42	44

The technological studies are intended to furnish the pupils with such information as relates directly to the production of textile fabrics. They include a thorough study of the nature and origin of raw materials, such as yarns, threads, etc., used in weaving; the technical features of textile fabrics with regard to design and the production of certain textile effects; installation and use of appliances and machinery used in weaving; and calculation of the strength and adaptability of materials used in the production of different kinds of fabrics. The other technical studies, such as descriptive geometry, machinery, and mechanical drawing enable graduates properly to understand drawings of machinery and to sketch the details of machines used in the weaving industry. They further teach the pupils the elements of machine

construction and give an insight into mechanical power transmission, motors, etc. The instruction in drawing is intended to educate the taste of the pupils in textile art and in pattern designing. The commercial studies include correspondence, commercial arithmetic, principles of exchange, and elementary bookkeeping, with special reference to the textile industry.

The practical work embraces, in the first year, general preparatory work and weaving on handlooms; in the second year, weaving and preparatory work on Jacquard, hand, and power looms. For this purpose the school is provided with workshops equipped with 42 hand and 22 power looms, besides machinery and apparatus for the preparatory work. The practical work is so arranged that pupils not only learn the various kinds of weaving, but are given an insight into the entire operation, from the raw material to the production of the finished article.

Candidates for admission must be graduates of the grammar schools or of the fourth-year class of an intermediate school or a school of like grade. They must be at least 14 years of age, and have a proper physical development. Although previous training in weaving is not absolutely required, experience has proved that those persons who have had a year or two of practical work in weaving can derive much greater benefits from the school. The four weeks' preparatory course is therefore required of all who have not had practical experience. The tuition fee is 10 florins ($4.06) per half-year term, the matriculation fee 2 florins ($0.81), while a fee of 5 florins ($2.03) is charged for materials used. Foreigners must pay double these amounts. Persons who do not possess the qualifications requisite for admission to the regular courses may be admitted as special pupils. In that case they must be at least 16 years of age, and must pay double the amount of tuition and other fees that are paid by regular pupils. If they take only single courses as special pupils, they pay according to the number of courses attended, but never less than 10 florins ($4.06). Needy pupils may be partly or wholly exempted from the payment of tuitions and fees. The school year begins September 16 and closes July 15. The preparatory course begins August 15. Regular pupils receive diplomas on graduating, and special pupils obtain certificates of attendance.

The course for pupils of the State Industrial School covers two years, and offers such pupils an opportunity to perfect themselves in the theoretical and practical work of weaving without interfering with their regular studies at the industrial school. Instruction is given five hours each week during the first year and three hours each week during the second year, and embraces the study of textiles, analysis, and practical work. This course is open only to pupils of the third and fourth classes of the mechanical divisions of the State Industrial

School. The tuition is 5 florins ($2.03) per year. Besides this a fee of 2 florins ($0.81) per year is charged for the use of materials.

The industrial continuation school is in session on Sundays and on week-day evenings. Its purpose is to give a special training in certain lines of textile work to young persons who are employed during the day. The regular evening course is intended mainly for persons who are employed in the local cloth-weaving industry, although pupils can also obtain instruction in cotton, carpet, and other weaving. This course covers two years. The subjects taught are the theory of weaving, practice in handloom weaving, and free-hand, pattern, and textile drawing. Instruction is given on Mondays and Fridays from 6 to 9 p. m., and on Sunday mornings. Candidates for admission must be over 14 years of age, must be graduates from the common schools, and must have a practical knowledge of weaving. The tuition is 5 florins ($2.03) per year, and a fee of 1 florin ($0.41) for requisites is charged. Needy pupils are exempted from paying tuition, and a part of the necessary books and requisites is also furnished them. The course lasts from September 16 to May 31.

The regular Sunday course serves a purpose similar to the evening course and is intended mainly for those persons who live some distance from Reichenberg. The instruction is the same as that given in the evening course, with the exception of drawing and the practical work. The conditions for admission, length of course, and fees are also the same.

In addition to these two continuation courses there is also a review course which covers a period of one year and is intended mainly for pupils who have graduated from the former, in order to give them a more thorough education, to specialize along certain lines, and to keep in touch with the most recent ideas in the science and art of textile work. This course is entirely optional. Admission to this school is conditioned upon previous attendance at the school for weaving. The tuition and fee for requisites are the same as in the evening school.

The workshop for power weaving is intended to instruct pupils one entire day of each week in the use of certain styles of power looms. Candidates for admission must be graduates from weaving schools and must have a practical knowledge of power-loom weaving. The tuition is 10 florins ($4.06) for the whole course, and 2 florins ($0.81) is charged for the use of materials.

The management of the entire institution is in the hands of a board consisting of the president of the chamber of commerce and 10 associates. The corps of instructors consists of a director, 4 technical instructors, 2 assistant technical instructors, 2 shop overseers, and 1 assistant teacher.

The school has received much encouragement from local firms in the

way of gifts of machinery, materials, etc. During the school term 1897–98 this school received for aid of various kinds to pupils a subsidy of 200 florins ($81.20) from the ministry of education, 150 florins ($60.90) from the savings bank of Reichenberg, and interest from various endowment funds amounting to 339 florins ($138).

At the beginning of the school term 1899–1900 there were 117 pupils at the school, of whom 39 were regular day pupils, 8 special day pupils, and 70 attended the continuation courses. During the school term 1896–97, 16 pupils graduated from the day school and 86 from the continuation school. Of 97 persons who graduated from the day school in 1895, 1896, and 1897, nearly all obtained employment in the textile industry, some as pattern designers at wages ranging from 12 to 20 florins ($4.87 to $8.12) per month in the beginning, and from 20 to 80 florins ($8.12 to $32.48) per month later on.

STATE SCHOOL FOR WEAVING, SCHÖNBERG.

This institution is designed to educate pupils by theoretical and practical instruction in such a way as to fit them to become manufacturers, managers, pattern designers, weavers, and merchants in the silk, linen, and woolen weaving industries. The school embraces three divisions: A day trade course of two years; an evening and Sunday course of one year, and an industrial continuation course of one year. A preparatory course of four weeks in practical weaving precedes the day course.

The day trade school is intended for graduates of the common, grammar, or intermediate schools who desire to take a two years' course of study in weaving. Instruction is given in the theoretical, technological, industrial art, commercial, and practical branches of the weaving industry.

The theoretical instruction during the first year includes the study of weaving on ordinary and Jacquard looms and the simpler forms of textile work. In the second year this instruction is continued, together with the study of the use and application of pattern cards in Jacquard looms and the production of such cards. The work is so arranged that pupils gradually acquire a theoretical knowledge of the art of weaving from its simplest to its most complicated form, and enables them to develop original designs and ideas in textile fabrics. Another feature of the theoretical work is the analysis of fabrics, textile calculations, determining the cost of production and selling price, etc. The analysis of fabrics is taught step by step, from the simplest to the most complicated fabrics, and is intended to cover all classes of woven goods. The greatest attention is given to this theoretical instruction, because it is a feature of textile knowledge which is indispensable to persons in higher positions, and which can not be acquired in actual practice.

The technological instruction embraces during the first year the study of materials, spinning, the technology of handloom weaving, and technical drawing; and during the second year it includes, in addition, the science of mechanics, machines and motors, the technology of power-loom weaving, and the sizing or finishing of fabrics. Pupils are given a knowledge of the different materials, their origin and use, etc., by means of text-books and mechanical and technical descriptions. They are instructed in the spinning processes of different materials and the quality and number of yarns and threads. The technology of hand and power weaving gives the pupils an idea of the construction and use of all machines, tools, and apparatus used in weaving and the adaptability of certain kinds of looms to certain styles of fabrics.

The industrial art branches, such as free-hand and pattern drawing and pattern-card designing, are intended to educate the artistic taste of pupils with regard to form and color and to enable them to design original patterns to be used in weaving. This is accomplished by systematic instruction in drawing and painting from objects, from plaster models, from fabrics, and from nature, such as plants, flowers, etc., special weight being given to the nature studies.

The commercial branches embrace penmanship, business forms, and industrial arithmetic in the first year, and exchange and industrial bookkeeping, in addition, in the second year. These commercial studies are intended to familiarize pupils with the office work of a weaving mill.

Instruction in the second year is divided into two groups. In the first group, besides the commercial and theoretical subjects, which are common to both, special attention is given to technological and practical exercises in weaving; in the second group emphasis is given to pattern and industrial drawing, and less attention to technological subjects.

Four workrooms are devoted to the practical work of this institution. These contain 26 handlooms and 12 power looms, together with the necessary machinery and apparatus for the preparatory operations, such as spooling, warping, beaming, twisting, etc., special attention being given to fancy linen, silk, and velvet weaving on hand and power looms. Beginning with the simplest work, pupils are taught, under the direction of master workmen, to fix the looms, to perform all the other preparatory work, and to weave marketable fabrics of cotton, linen, and silk, special importance being attached to the execution of perfect work.

Candidates for admission must be graduates of common, grammar, or intermediate schools, and must have the physical fitness for their chosen trades. Pupils who wish to take the second-year course must show that they have completed the first-year work in a weaving school having a two-year course. Instruction is free, but pupils must pay a

fee of 10 gulden ($4.06) for materials used. Foreigners must pay in addition a matriculation fee of 50 gulden ($20.30). Provision is made in the way of stipends, amounting to from 20 to 50 gulden ($8.12 to $20.30), for industrious pupils without means. At the end of each term pupils are given a certificate showing the result of the work for the year, and at graduation a certificate showing the result of the entire school work. The school year begins September 16 and ends July 15.

The evening and Sunday courses are open only to persons who are engaged during the day as factory officials, merchants, or weavers, and who therefore have no time on week days to educate themselves in the theory and practice of weaving. Entrance is conditioned upon a common school education and employment in the weaving industry. Journeymen and apprentices of all trades may be admitted as special pupils in the drawing courses. The instruction includes only such theoretical, industrial art, practical, and technological branches of the weaving industry as relate to hand weaving. Instruction is given on Tuesdays and Thursdays from 7 to 9 p. m. and on Sundays from 9 a. m. to noon. The school year begins September 16.

The trade continuation course is intended for graduates of the day and evening and Sunday courses who wish to perfect themselves in some special branch of weaving or in pattern drawing. The course is entirely optional and may extend over several years. It gives experienced workmen an opportunity to fit themselves to become master workmen or textile draftsmen. No tuition fees are required. Instruction is given on Thursdays from 7 to 9 p. m. and on Sundays from 9 a. m. to noon, and begins September 16 of each year.

The direction of the entire institution is in the hands of a board consisting of the mayor of Schönberg and 6 associates who are engaged in the textile industry. The teaching personnel comprises a director, 2 trade instructors, 3 master workmen, and 1 assistant teacher.

The institution receives the most active encouragement from persons engaged in the local textile industry. The school authorities maintain the closest relations with manufacturers by giving and receiving advice, supplying them with skilled workmen, and otherwise advancing their interests.

During the school term 1897–98 a subsidy of 150 gulden ($60.90) was received from the ministry of education for stipends for pupils without means; 106 gulden ($43.04) were realized from the sale of objects made in the school, and 550 gulden ($223) were received from other sources, all of which was used for stipends and other assistance to pupils.

In addition to the courses above enumerated there is a general industrial continuation school conducted in the same building under the same teaching personnel, but under a separate board of control, and is

considered as an independent institution. The purpose of this school is to afford an opportunity to journeymen and apprentices to obtain a theoretical and, as far as possible, a practical training in such branches of textile art, technology, and commerce as may be useful to them in the practice of their trades. The materials, objects, books, etc., used in the day and trade continuation courses are available for use in this school. The course comprises a preparatory class of two divisions, a first-year class of two divisions, and a second-year class.

Instruction is given on four week days from 7 to 9 p. m. and on Sundays from 9 a. m. to noon and from 1 to 4 p. m., and covers the following subjects: Preparatory class—reading, penmanship, composition, arithmetic, and drawing; first year class—business forms, arithmetic, geometry, and elementary free-hand drawing; second-year class—business forms, industrial bookkeeping and arithmetic, exchange, and industrial drawing. The school year begins October 1 and ends May 31, each pupil receiving a certificate upon graduation. Candidates for admission to this school must have graduated from the common schools and must have a knowledge of reading, writing, and arithmetic. Instruction is free in all the classes.

During the school term 1897–98, 262 pupils matriculated in the various classes conducted in this institution, of whom 238 remained until the close of the year. Of the 262 pupils, 53 attended the regular day courses, 23 attended the evening and Sunday courses, 9 attended the trade continuation course, and 177 attended the general industrial continuation school.

It is reported that the graduates of this school always find positions in textile establishments. Many of them are filling positions as superintendents or are owners of textile mills. The school authorities endeavor to place all their graduates in positions when they complete their school instruction. Of 130 persons who graduated from the day school in 1895, 1896, and 1897 all obtained employment in textile establishments as weavers, overseers, clerks, and pattern designers, at wages ranging from 360 to 500 florins ($122 to $203) per year.

STATE SCHOOL FOR WEAVING, WARNSDORF.

This institution comprises a day school and evening and Sunday courses. The day school undertakes, through theoretical and practical instruction, to educate persons for positions as overseers, master workmen, textile designers, and other occupations in textile establishments. The course covers two years. Instruction is given each week day from 8 a. m. to noon, and from 2 to 6 p. m., except Saturday. After satisfactory graduation from the last year's class, pupils may take an additional year of practical instruction, provided that in the

judgment of the director good results are likely to follow. The subjects taught and hours per week devoted to each are as follows:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, STATE SCHOOL FOR WEAVING, WARNSDORF.

Subjects taught.	Hours per week.	
	First year.	Second year.
Practical weaving	11	
Practical weaving on power looms		8
Practical weaving on treadle and Jacquard looms		5
Study of weaving	4	2
Analysis	5	6
Study of materials used in textile fabrics	2	
Technology of hand weaving	1	1
Technology of machine weaving		3
Free-hand and trade drawing	8	
Free-hand drawing		3
Pattern designing	4	4
Geometrical drawing	2	
Technical drawing		2
Study of machinery		1
Sizing and finishing		1
Bookkeeping		3
Business forms	1	1
Arithmetic	2	1
German	2	2
Penmanship	1	
Total	43	43

The evening and Sunday courses afford an opportunity to master workmen, journeymen, and other textile workers to perfect themselves in their respective occupations. The subjects taught include reading, drawing, and commercial science. Instruction is given on Sundays from 9 a. m. to noon, and from 8 to 9.30 p. m. on week days except Saturday. The course of instruction covers two years. The subjects taught and hours per week devoted to each follow:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, EVENING AND SUNDAY COURSES, STATE SCHOOL FOR WEAVING, WARNSDORF.

Subjects taught.	Hours per week.
Free-hand and industrial drawing	6
Study of weaving	1½
Analysis and textile calculation	1½
Technology of power weaving	3
Bookkeeping and arithmetic	3
Penmanship	1
Practical weaving on power looms	3
Practical weaving on hand looms	1½
Total	20½

Candidates for admission to the day school must be 14 years of age and must be graduates of the common schools. Each regular pupil, upon entering the school, must bring a statement from his father or guardian pledging himself to see to the regular attendance of the pupil. Pupils who are 24 years of age or over must sign this declaration themselves. The school year begins September 15 and ends July 15 of the following year. Entrance to the first-year course must be

preceded by a four weeks' practical course beginning July 20. This course is intended to instruct pupils in the use of looms and in preparatory operations. The tuition fee is 20 florins ($8.12) per year, but foreign pupils must pay 50 florins ($20.30) per year. The fees for special pupils are fixed by the director of the school. Pupils who are unable to pay the tuitions are exempted from these payments. Pupils of the evening and Sunday courses, which begin October 1 and end July 30, pay 2 florins ($0.81) per year for the theoretical course and 3 florins ($1.22) per year for the practical course.

The management of the school is in the hands of a board consisting of the mayor of Warnsdorf and 6 associates, who are generally textile manufacturers. The teaching personnel consists of the director, 4 technical instructors, 2 master workmen or overseers, and 1 assistant teacher for German and penmanship. The most cordial relations exist between this school and the local textile firms. Numerous excursions are made by pupils, under the guidance of the director or the instructors, to local and other establishments for the purpose of getting practical knowledge and advice.

At the beginning of the school term 1899–1900 there were 127 pupils in attendance at this school. Of this number 22 were regular and 9 were special day pupils, and 96 attended the other courses. Of 105 persons who graduated during the years 1895, 1896, and 1897, all obtained employment in the weaving industry, at wages ranging from 20 to 30 florins ($8.12 to $12.18) per month.

STATE SCHOOL FOR WEAVING AND KNITTING, ASCH.

This institution embraces a day trade school and an industrial continuation school. The day school includes a department for weaving, one for knitting, and one for textile drawing. In each of these departments the course of instruction covers two years of ten months each. The industrial continuation school includes a course for weavers and a course for knitters.

The trade school for weaving aims to educate pupils for positions as weavers, master weavers, overseers, superintendents, manufacturers, and persons who wish to perfect themselves as buyers or sellers in the manufacturing branch of the textile industry. The instruction covers all branches of the weaving industry, although in the second year special attention is given to the particular branch chosen by the pupil.

The theoretical instruction embraces the technical, industrial art, and mercantile branches of the textile industry, analysis of fabrics, and technical drawing. This theoretical work is intended to give the pupils a knowledge of the composition, nature, and value of textile fabrics and to develop their artistic taste and ideas of color harmony. The technical branches, such as mechanics, science of machines and

motors, study of materials, the technology of spinning, of power-loom weaving, and of sizing, and industrial hygiene, are intended to give pupils the necessary knowledge of the machinery used in the textile industry, the technical properties of raw materials used, and the adaptability of particular styles of looms for the production of certain kinds of fabrics, etc. The instruction in geometrical perspective and mechanical drawing is intended to teach pupils to sketch the machinery, fittings, etc., in textile establishments. The mercantile instruction covers the necessary business forms used in this industry, bookkeeping, and exchange.

The greatest importance is attached to practical shopwork. The pupils are taught all the branches of their future occupation, much emphasis being given to clean and accurate work. In the hand-weaving room the pupils are taught the preparatory work and elementary processes of weaving, and are given an opportunity to familiarize themselves with the complicated mechanisms of ordinary and Jacquard looms. This practical work makes it easier for the pupils to comprehend the lectures on hand and Jacquard weaving. In the power-loom weaving room the pupils learn all the various preliminary operations of power-loom weaving, such as spooling, warping, beaming, piecing, etc.

Candidates for admission to the trade school for weaving must be over 14 years of age and must have graduated from the common schools. The matriculation fee is 1 gulden ($0.41), but foreigners pay 2 gulden ($0.81). The tuition fee is 20 gulden ($8.12) for Austrians and 50 gulden ($20.30) for foreigners. Special pupils pay one-half the regular tuition for a course of five weeks and the whole tuition when the course extends over five weeks. Provision is made for free scholarships for worthy and industrious pupils. The school year begins September 16 and closes July 15.

The trade school for knitting is intended to prepare pupils, by theoretical and practical instruction, to become master workmen and buyers and sellers of fabrics in the knitting industry. The plan of instruction is similar to that employed in the school for weaving, knitting being substituted for weaving. The terms for admission, length of courses, tuitions, etc., are the same as in the school for weaving.

The trade school for textile drawing aims to train pupils to become textile draftsmen. The course of instruction is similar to that of the school for weaving except that more attention is paid to the industrial art branches and correspondingly less to other work. The terms of admission, length of course, tuition, provisions for needy pupils, etc., are similar to those in the school for weaving.

The purpose of the industrial continuation school for weavers is to afford an opportunity to persons employed during the day to perfect themselves in the theory and practice of the weaving industry.

Instruction is given on Tuesdays and Thursdays from 7 to 9 p. m. and on Sundays from 8.30 to 11.30 a. m. The course of instruction covers one year, although pupils may attend for a longer time in order to become more thorough in the branches taught. Candidates for admission must be over 14 years of age, must have graduated from the common schools, and must have previous knowledge of practical weaving. In the drawing class special pupils are admitted who are under 14 years of age. The theoretical work embraces instruction in the art of weaving, analysis of fabrics, textile calculations, the technology of hand weaving and of materials used, and free-hand drawing. In the workshop of the school the pupils are given an opportunity to learn the various preparatory operations as well as that of weaving.

The trade continuation school for knitters is intended to give to young persons employed in knitting operations the same opportunities that the preceding school gives to weavers. The period of instruction and terms of admission are similar to those for the weaving school.

The tuition fee of the trade continuation department is 4 gulden ($1.62) for Austrians and 8 gulden ($3.25) for foreigners. Needy pupils may be admitted without the payment of a tuition fee by obtaining a certificate from the Bohemian government. Foreigners are never exempted from the payment of tuition.

The entire institution is under the management of a board consisting of the mayor of Asch and 9 associates who are engaged in the weaving industry. The corps of instructors consists of a principal, 9 teachers, and 1 assistant teacher.

In 1896–97 the day school for weaving graduated 19 pupils, the school for knitting 4 pupils, the trade continuation school for weaving 55 pupils, and the trade continuation school for knitting 13 pupils. At the beginning of the school term 1899–1900 there were 106 pupils at the school, of whom 26 attended the day classes and 80 the continuation classes. The school has received much assistance from local textile firms and the most cordial relations exist between them. During the school term 1897–98 the sum of 150 florins ($60.90) was received from the savings bank of Asch and 280 florins ($114) from the ministry of education for the assistance of needy and industrious pupils.

The school does not undertake to provide good positions for graduates, its object being to educate workmen in such a way as to enable them eventually to fill positions as master workmen, overseers, or manufacturers. Of the 74 persons graduated from the day school during the years 1895, 1896, and 1897, 64 obtained employment in textile establishments, at from 5 to 10 florins ($2.03 to $4.06) per week, as textile workers, office men, and pattern designers.

STATE SCHOOL FOR THE TEXTILE INDUSTRY, VIENNA.

The purpose of this school is to give a thorough education in both the theory and practice of the various textile occupations. It is organized in two departments, which are nearly separate schools. The first, or trade school proper, consists of three sections, relating, respectively, to weaving, knitting, and industrial drawing. Each section has a day course continuing for two years. It is expected that pupils completing these courses will be competent to take places of responsibility, such as overseers, superintendents, etc. The requirements for admission to these courses are that the candidates shall be 14 years of age or over and have completed a course in a grammar school, a school of arts and sciences, or a school of similar standing. In the case of minors the consent of the parents or guardians must be obtained. For those who have already had a technical education a special course of study may be prescribed.

Instruction is given by a corps of teachers consisting of the director, who also teaches drawing, pattern making, and flower painting, and professors of composition and the technology of hand weaving, geometry, mechanical technology and machine drawing, drawing in relation to textile patterns, style, colors, the history of art, practical weaving on power and hand looms, and practical knitting.

The second department consists of three continuation courses, which relate to (1) weaving, designing, etc., (2) knitting, and (3) fringe, lace, and ribbon making. These three courses are given in the evenings and on Sundays, and continue for two years of ten months each. The purpose of these courses is to permit apprentices and other workers in the textile industry to complete their trade education. For the most part, the pupils in these courses have already had practical experience in their trades, and consequently the instruction given in the school is almost wholly theoretical. Instruction is free to apprentices and workmen in the textile industry. Others pay a small fee. The following statement shows the occupations of the pupils in attendance during the year 1897–98:

OCCUPATIONS OF PUPILS OF CONTINUATION COURSES, STATE SCHOOL FOR THE TEXTILE INDUSTRY, VIENNA, 1897–98.

Occupations.	Journeymen.	Apprentices.
Pattern designers	19	47
Porcelain painters	9	2
Fringe makers	5	95
Weavers	29	25
Knitters	9	11
Ribbon workers	4	4
Clerks in textile houses	31	.....
Total	106	184

Teachers in these courses are the same as those for the day school. To encourage diligence, many prizes, medals, and diplomas are given.

The following statement shows the total attendance upon the two sections for the school year 1897–98, classified according to age periods:

ATTENDANCE AT STATE SCHOOL FOR THE TEXTILE INDUSTRY, VIENNA, 1897–98.

Age periods.	Trade school proper.	Continuation school.
13 to 15 years	7	162
15 to 17 years	22	20
17 years or over	37	108
Total	66	290

The work of the school is supervised by a board composed of business men and manufacturers. It is also subject to State inspection. Regarding the results accomplished, the director of the school reports that the graduates have little difficulty in finding employment and that they give general satisfaction. In one of his annual reports he says that the relations between the school and the industrial establishments are close, a condition of affairs that is of great value to the school; also that there is scarcely a textile establishment in Vienna that does not include one or more of its former pupils, many of them holding high positions. The 195 weavers who graduated from this school in 1895, 1896, and 1897 have mostly obtained positions in mills or as pattern designers at wages ranging from 500 to 800 florins ($203 to $325) per year.

Schools for Wood, Iron, and Stone Work.

STATE SCHOOL FOR BASKET MAKING, BLEISTADT.

The purpose of this school is to give systematic, theoretical, and practical instruction in basket making and in willow culture. The complete course of instruction covers three years, because the basket makers are not trained in any special branch, but in all lines of this industry.

Candidates for admission to the regular and special courses must be graduates of the common schools. Each of the regular pupils is received on probation for two months, after which time his admission to the school is determined. The school opens September 16 and closes July 30.

The practical work in willow culture usually begins about April 1 and lasts until May 31, instruction being given from eight to ten hours per week in this work. For this purpose the school utilizes a willow nursery 100 square meters (1,076 square feet) in area, and a willow plantation of about 6,600 square meters (71,042 square feet). The theoretical instruction in willow culture precedes the practical work, and is given one hour each week from October to March, inclusive.

The instruction in industrial drawing given at this school enables the pupils to design and execute the various kinds of willow ware. Stenography and gymnastics may be taken up by the pupils as optional studies.

The income of the school depends to a certain extent upon the proceeds from the sale of articles made by the pupils of the third-year course, but only such pieces of work are taken as fit in with the regular course of instruction. Weekly sums of money are paid as premiums to pupils executing good work. Stipends are granted to indigent and worthy pupils. The latter are also given free medical aid when needed.

The management of the school consists of a board of 9 persons. The director of the school is the only instructor. Subsidies are received from various sources, which during the term 1897–98 amounted to 310 florins ($126).

At the beginning of the school term 1899–1900, 23 pupils attended the school, of whom 14 were regular and 9 were special. Of the 18 persons graduated from this school in 1895, 1896, and 1897, 17 obtained employment in the basket-making industry.

STATE SCHOOL FOR BASKET MAKING AND WILLOW CULTURE, FOGLIANO.

The purpose of this school is to improve the local cottage industry of basket making and to place this industry on a basis of successful competition with the foreign trade. The course of instruction, which is both theoretical and practical, covers three years.

The theoretical instruction includes commercial arithmetic, reading and writing in the German and Italian languages, industrial drawing, willow culture, and study of materials and tools used in the basket-making industry. Practical instruction in the workshop, which takes up the greater part of the time, embraces all branches of basket work as well as the manufacture of wickerwork furniture. It also includes practical work in willow culture.

Candidates for admission must be 14 years of age, must be graduates of the common schools, and must be physically adapted to this work. The instruction is free, except to foreigners, who are required to pay a tuition of 50 florins ($20.30) per year. Upon graduating, pupils receive a certificate which entitles them to the practice of their trade of basket making.

The teaching personnel of this school consists of a director, an assistant instructor, and a foreman. During the school term 1897–98 the school received a subsidy of 200 florins ($81.20) from the ministry of education, and 100 florins ($40.60) from the sale of objects made by the pupils, which sums were used for stipends to worthy and indigent pupils.

At the beginning of the school term 1899–1900 there were 9 regular and 3 special pupils at the day school. Four persons were graduated in the years 1895, 1896, and 1897, all obtaining employment as basket makers.

STATE SCHOOL FOR WOODWORKING, BERGREICHENSTEIN.

This institution comprises a day trade school and an industrial continuation school. The purpose of the day school is to give such practical and theoretical training as will enable persons to work independently and with good results in the various branches of the woodworking industry. It is divided into the following trade sections: Furniture making and carpentry; wood turning, carving, and pyrography; wagon making; joinery and woodenware making, and cooperage. The period of instruction in furniture making and carpentry is four years and that of the other branches three years. The school opens September 16 and closes July 31.

The theoretical instruction embraces religion, German business forms, industrial arithmetic, geometry, free-hand drawing, geometrical drawing, perspective and shading, architecture, free-hand drawing from models, technology of wood, bookkeeping, penmanship, industrial drawing, and styles of ornamentation. All this instruction is given in accordance with a fixed programme. Instruction in the drawing branches is such that pupils after graduating are able to make correct working drawings, sketches, and designs. In the workshop pupils are instructed by experienced master workmen in all the grades of manual work. The graduating certificates entitle pupils to practice the trades of carpentry, wood turning, wagon making, and cooperage.

The industrial continuation school consists of two classes and undertakes to give apprentices in this industry such industrial, technical, and commercial instruction as will be useful to them in their vocations.

The school received during the school term 1897–98 from various sources 1,386 florins ($563) for the aid of indigent and worthy pupils. In addition to such contributions, 1,200 florins ($487) per year are received from the State and communal authorities of Horitz for stipends. A number of families in the city furnish free dinners to indigent pupils.

The school is managed by a board consisting of 10 persons, most of whom are engaged in local industries. The teaching personnel consists of the director, 2 trade instructors, 6 foremen, and 4 assistant instructors.

At the beginning of the school term 1899-1900, 53 pupils attended the regular day school and 92 attended the continuation classes, making a total attendance of 145. The 18 persons graduated from the day school in 1895, 1896, and 1897, all obtained employment in woodworking establishments as cabinetmakers, wagon makers, wood turners, designers, and foremen.

STATE SCHOOL FOR THE WOODWORKING INDUSTRY, BOZEN.

This institution embraces a day trade school, an open drawing and modeling hall, a general industrial continuation school, a drawing course for girls, and a drawing course for pupils of the common schools.

The day trade school trains pupils as journeymen, foremen, draftsmen, and pattern makers in the woodworking industries by means of practical and theoretical instruction. It also aims in other ways to advance the interests of the local woodworking industry. Special attention is given to woodworking in connection with church architecture. The school is divided into the three trade sections of joining, wood carving, and wood turning.

The course of instruction covers a period of three years. A preparatory course is given to persons who are not prepared to enter the regular trade courses. This preparatory course not only serves to displace from one to two years of the common school, but also gives an elementary training in joining, wood carving, and wood turning, and in the use of tools. The principal subjects taught in the trade divisions are: Drawing, including elementary and free-hand drawing from models, geometrical drawing, perspective and shading, architectural styles, and industrial drawing; various technical subjects, such as nature studies and mechanical and chemical technology of wood, and commercial subjects, such as industrial arithmetic, business forms, and bookkeeping. These subjects are taught systematically and with special reference to the requirements of practical work. The practical instruction, to which the greatest importance is attached, is given in the workshop under the direction of instructors and foremen. Books, models, and a collection of technical and antique objects relating to the woodworking industry are on hand for the use of instructors and pupils. The school also admits special pupils.

The school opens September 1 and closes July 15. In order to enter the preparatory course pupils must be 12 years of age and must have a satisfactory scholarship record in the common schools. Candidates for admission to the trade divisions must be 14 years of age, must be physically fitted for their chosen occupation, and must have a theoretical knowledge such as is given in the preparatory course. A tuition fee of 3 florins ($1.22) per term is charged, indigent and worthy pupils being exempted from this payment. Foreign pupils, who can be admitted only by special permission of the ministry of education, must pay a tuition fee of 30 florins ($12.18) per half-year term. A matriculation fee of 1 florin ($0.41) is charged.

The open drawing and modeling hall gives an opportunity to journeymen and manufacturers in the woodworking industry to get a training in drawing and modeling and in making sketches and plans of work to be executed, to use the collection of models and objects of the

day trade school, to study industrial art, and receive technical advice and information. No fees are charged for these services.

The general industrial continuation school is intended for apprentices of Bozen, and offers an opportunity to obtain a theoretical and, as far as possible, a practical and technical training in such industrial-art and commercial branches as will be of benefit to them in the practice of their trades. It comprises a preparatory course and two one-year courses. Reading, writing, arithmetic, and drawing are taught in the preparatory course, and industrial arithmetic, business forms, bookkeeping, free-hand, geometrical, and industrial drawing are taught in the regular courses. Instruction is given on Sundays from 9 to 11 a. m., and on week days, except Saturday, from 7 to 9 p. m. The school opens October 1 and closes April 30. Instruction is free, and the drawing and writing materials are furnished to the pupils.

The drawing course for girls is intended to give instruction in drawing and such a degree of training in style and decorative art as will be useful to them in their handiwork and in tastefully arranging their homes. To this end exercises are given in pattern drawing, painting on silk and wood, and pyrography. The course begins October 1 and ends June 30. No charge is made except a matriculation fee of 1 florin ($0.41).

The drawing course for pupils of the common schools is intended to give a training in drawing which can not be obtained in the common schools. It also aims to prepare these pupils to enter the trade school. Instruction is given for two hours on certain afternoons of the week from October 1 to June 30. No fees of any kind are charged.

The entire institution is managed by a board consisting of the mayor of Bozen and 8 associates, most of whom are engaged in the woodworking industry. The teaching personnel consists of a director, 3 foremen, 7 trade instructors, and 3 assistant instructors.

An important feature of this institution is to advance the interests of the small local industries by loaning objects, specifications, and models; preparing, free of charge, drawings, plans, etc., for special work; giving advice concerning methods of work and sources of information, and preparing cost and price lists.

During the school term 1897–98 the continuation school received a subsidy of 200 florins ($81.20) from the ministry of education and one of 200 florins ($81.20) from the provincial diet. The school received from various sources, for scholarships and stipends, sums amounting to 1,280 florins ($520).

At the beginning of the school term 1899–1900, 171 pupils attended this institution. Of these, 43 were regular and 4 were special pupils of the day trade school, 101 attended the continuation school, and 23 attended other courses.

Of the 14 persons graduated from the day school in 1895, 1896, and

1897, 11 obtained employment in the woodworking industry as journeymen, at wages ranging from 7 to 12 florins ($2.84 to $4.87) per week.

STATE SCHOOL FOR WOODWORKING, CHRUDIM.

This institution comprises a day trade school, an industrial continuation school, an open drawing and modeling hall, and a course in modeling for pupils of the grammar school.

The day school has a preparatory course and a trade course, the latter being divided into sections for cabinetmaking and carpentry, for wood carving, and for wood turning. Its purpose is to give theoretical and practical instruction in these trades. The preparatory course covers two years and the trade course three years. The preparatory course is intended for those persons who have had no previous preparation for entrance upon the regular trade course, and imparts such theoretical and practical knowledge as will enable pupils to take up the trade course. Persons who have had previous theoretical and practical training can immediately enter upon the trade course and graduate in three years. As the preparatory course may be begun at the age of 12 years, pupils can graduate from the day school at 17 years of age.

The theoretical instruction of the day school embraces general education, industrial art, technical, and commercial branches. The general educational branches, which are for the most part taught in the two years' preparatory course, replace such studies as would be taught pupils of the common school at the ages of 13 and 14 years. Special attention is paid to drawing, which includes free-hand drawing, perspective, shading, etc. In the instruction in drawing the endeavor is made to teach pupils to make correct working drawings from sketches and to execute original designs of simple objects used in the trades. The technological branches embrace the teaching of building, the technical properties of wood, the use of tools and woodworking machinery, the installation and arrangement of workshops with special reference to motors, power transmission, and adaptability of certain motors to small industries, and the provisions to be made for the health and safety of workmen. In the commercial branches pupils are taught the important business forms and usages in commercial transactions, bookkeeping, and the study of selected portions of the industrial code.

More than one-half the time of the pupils is devoted to shopwork. In the first year of the preparatory course all pupils are instructed alike in carpentry, wood carving, and turning, but in the second year they are classified according to their chosen trades. In the regular trade courses pupils begin by making simple objects, and are gradually taught the different methods of work which finally fit them for the execution of larger and more complicated pieces.

Candidates for admission to the preparatory course must be over 12 years of age and must have attended the common schools for six years. In the trade-school courses, candidates must be 14 years of age, must have passed through the two years' preparatory course, and must have the necessary physical qualifications for the trade chosen. The education obtained in the preparatory school may be replaced by that of a two years' course in a handicraft school, or in a public school if candidates can show that they have obtained a sufficient practical experience. In the admission of candidates preference is given to sons of persons engaged in the woodworking industries; and if such pupils are indigent and worthy, special provision is made for them in the way of stipends and other assistance. Persons who have had practical experience in this industry are also given a preference, and experience has shown that the best results follow the instruction of this class of pupils.

The school year begins September 16 and ends July 31. Instruction is free, but foreign pupils must pay tuition. Special stipends are provided for indigent and worthy pupils, the money for this purpose being provided by the ministry of education, the Prague Chamber of Commerce and Industry, and the local aid society, the last mentioned also supplying books, drawings, materials, etc., to needy pupils. Special day-school pupils are permitted to attend classes in single branches of study. The number of these depends upon the capacity of the school.

The general industrial continuation school aims to give apprentices and helpers in this industry theoretical and, as far as possible, practical instruction in those industrial art, technical, and commercial branches which are useful to them in their trades. This continuation school comprises a preparatory one-year course and a two-year industrial course. Candidates for the continuation classes must have completed their common-school education and must have a good knowledge of reading, writing, and arithmetic. The preparatory course embraces reading, writing, arithmetic, and drawing. The industrial course embraces business forms, industrial arithmetic, bookkeeping, free-hand drawing, geometry and geometrical drawing, trade drawing, and modeling. Instruction is given on week days, except Saturdays, from 7 to 9 p. m., and on Sundays from 9 a. m. to noon. On account of the limited time given to instruction and the exhausted condition of the pupils, who are compelled to work at their trade during the day, graduates are encouraged to attend the open drawing hall or the regular trade school. All apprentices of members of the local guilds, except those of bakers, butchers, and barbers, are required to attend this continuation school. The school opens October 6 and closes April 30. Tuition is free, but a matriculation fee of 30 kreutzers ($0.12)

must be paid. Indigent pupils are exempt from this payment. Books and other requisites are furnished free of charge to the pupils.

The drawing and modeling hall is open during the usual day and evening school hours to persons engaged in the woodworking industry. Here graduates of the industrial continuation school may continue their instruction in industrial drawing. Instruction is also given to young women three times per week, from 1.30 to 3.30 p. m., during the winter months, in the open drawing hall for women. This comprises ornamental free-hand drawing and drawing from patterns for white and colored embroidery. The women are also taught the art of tastefully decorating their homes. The course begins October 1 and ends July 31. Instruction is free.

The modeling course for boys of the public schools is intended to give them an opportunity to learn elementary modeling in clay and to make plaster casts. Boys of the second and third year classes of the public schools of Chrudim are admitted to this course as far as the capacity of the school permits. Instruction is given free from 2 to 4 p. m. on Wednesdays and Saturdays from September 18 to July 15.

The school management consists of the mayor and 8 associates. The teaching personnel comprises a director, 9 trade instructors, 2 assistant instructors, and 3 foremen.

This institution undertakes also to advance the interests of the small industries of the locality by loaning, gratuitously, drawings, specifications, and models of articles made in the school; giving advice on important subjects, such as sources of materials used, calculating the cost of production, etc., giving public lectures, sending representatives to expositions, turning over large orders to individual manufacturers, etc. The school has a collection of drawings, models, and other objects for the use of manufacturers in other lines of work, such as locksmithing, fancy wrought-iron work, stonecutting, ceramics, etc.

During the year 1897–98 subsidies for the aid of indigent pupils, amounting to 3,591 florins ($1,458), were received from the ministry of education and from other sources.

At the beginning of the school term 1899-1900 the attendance of the school was 381 pupils. Of this number 79 were regular and 2 were special day pupils, 219 attended the continuation school, and 81 attended other classes.

Graduates of the day school generally begin work as journeymen. Those who served as journeymen before entering the school often obtain good positions at once, such as foremen or managers. According to the statement of the director, the school does not undertake to train finished skilled workers. In all trades it is necessary to have some years of practical training to become thoroughly efficient, and such experience can not be obtained in any trade school. In this respect, however, the trade school prepares the worker for obtaining

greater benefit from such experience by giving him a good fundamental education. Of 34 pupils who graduated from the day school during the years 1895, 1896, and 1897, 33 obtained positions as journeymen, draftsmen, and foremen in Vienna, Salzburg, and in Bohemia, the foremen at wages averaging 50 florins ($20.30) per month and the journeymen and draftsmen at wages ranging from 7 to 15 florins ($2.84 to $6.09) per week. One graduate entered the *Technikum* at Mittweida, Saxony.

STATE SCHOOL FOR WOODWORKING, EBENSEE.

The object of this school is to give the necessary theoretical and practical training to fit persons for the practice of the various woodworking trades. The institution comprises a day trade school, an open drawing hall, and a drawing course for pupils of the public schools.

The day trade school is divided into six sections as follows: (1) Ornamental and figural wood carving, (2) special course in animal figure carving, (3) cabinetmaking, (4) wood turning, (5) carpentry, (6) toy making and papier-maché work. Workshops, in charge of practical instructors, are provided for the manual work. The theoretical work comprises drawing, geometry, modeling, arithmetic, and industrial bookkeeping, special attention being given to the development of the artistic taste in pupils.

The course of instruction in the day school covers a period of four years, both regular and special pupils being admitted. Candidates for admission as regular pupils must be graduates of the common schools and must be physically fitted for the trades chosen. The school year begins September 16 and ends July 31. No tuition fee is charged. Certificates of graduation are given pupils upon the completion of the course, which entitle them to the practice of their trades as skilled workers.

The programme of instruction and hours per week are: First year—Ornamental free-hand drawing, six hours; geometrical drawing, three hours; business forms and arithmetic, two hours. Second year—Free-hand drawing from models, six hours; perspective and shading, three hours. Third year –Architecture, four hours; industrial drawing, four hours; business forms and bookkeeping, two hours. Fourth year—Industrial drawing, four hours; bookkeeping, one hour; modeling, four hours for pupils of the carving section; wood construction work, two hours for pupils of the carpentry section. The greater part of the time is devoted to instruction in the workshops. There the pupils are systematically instructed in their particular lines of trade, special stress being laid on exact work. In the last two years of each course pupils are required to produce marketable objects, which they execute from their own drawings.

The open drawing hall for men is intended to give instruction in free-hand and industrial drawing to journeymen, graduates of the school, or other young persons employed during the day. Instruction is given from 5 to 7 p. m. on Mondays and Thursdays from October 1 to May 31.

The drawing course for school children is intended to give better instruction in drawing than can be given in the common schools. This course is especially intended for pupils who wish to enter the trade school, and aids them in selecting their proper vocations. Instruction is given to older pupils from 8 to 11 a. m. on Saturdays and to younger pupils from 3.30 to 5 p. m. on Mondays and Thursdays from September 17 to July 15.

The teaching personnel consists of a director, 5 trade instructors, and 4 foremen of workshops. The relations between this school and the local woodworking industry are confined to advice, drawings, etc., given to cabinetmakers, there being no other woodworking industries in the immediate vicinity. Plans and drawings are executed from time to time for various woodwork decorations for buildings and churches. The school endeavors to be of assistance to manufacturers in the woodworking industry not only of Ebensee, but of other localities.

During the school term 1897–98 a subsidy of 650 florins ($264) was received from the provincial council and 100 florins ($40.60) from the town of Ebensee. For the purpose of giving stipends to worthy pupils, 500 florins ($203) were contributed by the ministry of education and 610 florins ($248) were received from other sources.

At the beginning of the school term 1899–1900 there were 114 pupils at this school, of whom 44 attended the day school as regular pupils and 4 as special pupils, and 66 attended the other classes. Of the 20 persons graduated from this school in 1895, 1896, and 1897, 15 obtained employment in the woodworking industry as carvers, cabinetmakers, turners, and carpenters.

STATE SCHOOL FOR WOODWORKING, HALLEIN.

This school comprises a day trade school, an open drawing hall, a drawing school for pupils of the public school, and an industrial continuation school.

The day school is intended to educate, by means of theoretical and practical instruction, young persons for the practice of the trades of wood carvers, cabinetmakers, wood turners, and carpenters. The course of instruction for each of these trades covers four years. The day courses consist of a preparatory course and special courses in ornamental and figural wood carving, joining and cabinetmaking, wood turning and fancy woodwork, and carpentry work.

The theoretical instruction embraces educational, technical, indus-

trial art, and commercial branches, the greater part of the instruction being given, however, in the workshop. By means of instruction in drawing, which includes free-hand, geometrical, and industrial drawing, drawing from models, perspective and shading, and architectural drawing, pupils are taught to produce correct constructive and artistic work, to draw from sketches, and to design and execute simple objects. Pupils in wood carving are also instructed in the elements of anatomy, and in the carpentry division special attention is given to architectural drawing, the art of building, machine construction, bridge and waterworks construction, etc. The technological training includes a study of materials and tools, technical properties of wood, and the uses of machinery in woodworking. In the commercial branches instruction is given in the most important business forms and correspondence, elementary bookkeeping, and commercial arithmetic. The greatest attention, however, is paid to instruction in the workshop, where pupils learn the necessary manual skill which enables them to gain a livelihood in a private establishment.

The school session begins September 16 and ends May 31. Candidates for admission to the day trade school must be 14 years of age and must have completed the common-school education. Stipends are granted to indigent and worthy pupils. Tuition is free, except to foreigners. The necessary books, instruments, and other requisites are furnished free of charge to pupils. Each pupil, upon graduating, is given a certificate entitling him to practice his trade as a skilled workman. In addition to the regular pupils the school also admits, as special pupils, apprentices, journeymen, and master workmen in the building, industrial art, and other trades who wish to pursue certain lines of study. Stonecutters' apprentices, wood carvers, cabinetmakers, etc., working in this and in neighboring towns often avail themselves of this opportunity.

The open drawing and modeling hall is intended to give to persons engaged in this industry and to graduates of this school an opportunity to practice in free-hand and industrial drawing and in modeling. Instruction is gratuitous, and is given on Sundays from 9 a. m. to noon.

The drawing course for pupils of the public schools enables them to get a better knowledge of drawing than is obtainable in the common schools. The instruction in this course is given free of charge on Wednesdays and Saturdays from 1 to 3 p. m. from September 17 to July 15.

The industrial continuation school is intended to give apprentices of the local industries theoretical and practical instruction in such industrial art, technical, and commercial branches as they may utilize to their advantage in their occupations. The school comprises a preparatory class, in which reading, writing, arithmetic, and elementary

drawing are taught, and two classes in free-hand, geometrical, and industrial drawing, and industrial arithmetic and bookkeeping. Instruction is given from 5 to 7 p. m. on four week days and from 10 a. m. to noon on Sundays. Attendance at this school is compulsory for apprentices in Hallein. The course opens October 1 and closes April 30.

The trade school proper and the continuation school are each managed by a separate board consisting of the mayor and 5 associates. The teaching personnel of the trade school consists of the director, 3 trade instructors, 2 foremen, and 3 assistant instructors. The personnel of the continuation school consists of the director of the trade school and 6 instructors.

Besides training young men for the woodworking trade, this institution endeavors to further the interests of this industry in this locality by supplying drawings and models, loaning books, and giving advice to local manufacturers. During the school term 1897–98 the school received subsidies amounting to 458 florins ($186) from the provincial diet, the chamber of commerce of Salzburg, the town of Hallein, and the local trade guilds. Sums amounting to 946 florins ($384) were received from various sources to be used as stipends for indigent worthy pupils.

At the beginning of the school term 1899–1900 the attendance at this institution was 231 pupils. Of these, 51 were regular and 11 were special day pupils, 61 attended the industrial continuation school, and 108 attended the other courses.

Of the 21 persons graduated from the day school in 1895, 1896, and 1897, 17 obtained positions as journeymen in the woodworking industry at wages ranging from 350 to 1,000 florins ($142 to $406) per year. The director of this school in his report for the school term 1897–98 made the following statement: "The transition of graduates from the school to private workshops is the most trying period because they are expected to do not only good but also rapid work. These graduates must compete with skilled workers who devoted their entire apprenticeship to practical work, while nearly half of the graduates' time was devoted to general and theoretical education, and the latter are therefore at a disadvantage with regard to rapid work. If, however, the graduate is apt and energetic, he will soon pass over this period, will acquire the speed of his fellow-workers, and will in addition have an opportunity to demonstrate the value of his school training, so that foremen, superintendents, and managers will find them a valuable aid in the preparation of plans and specifications and in the execution of work therefrom." In this manner graduates have at times risen to important positions, although the school does not aspire to educate foremen, superintendents, or draftsmen.

STATE SCHOOL FOR WOODWORKING, LAYBACH.

This school gives both theoretical and practical instruction in the different branches of the woodworking trade. It has special departments for carpentry and cabinetwork, wood turning, wood carving, and figure carving. There are also two other departments—one for basket making and one for trade drawing. The latter is an open drawing hall to which artisans can resort for making trade drawings under competent instruction.

In all the courses great attention is given to drawing. The technical courses include instruction in such matters as the operation of small motors, the properties of wood, the planning of workshops, business principles, and industrial hygiene. The greater part of the time of the pupils is devoted to practical work in workshops. Four years are required to complete the course in each of the sections devoted to woodworking practice. The basket-making course is for two years only.

Two classes of attendants are received—regular and special pupils. Tuition is free to Austrians. Foreigners pay a tuition fee of 100 florins ($40.60). Regular pupils receive text-books and other requisites free. Women are admitted to the department for basket making. Candidates for admission must have completed their primary education and must be at least 14 years of age. The open drawing hall is free to employers and workmen, and instruction is given them on Sundays from 8 a. m. to noon. The corps of teachers includes 13 persons. The attendance at the beginning of the school term 1899–1900 was 128, of whom 75 were regular and 12 were special day pupils, and 45 attended the other courses.

In but exceptional cases do graduates enter immediately into responsible positions. They must work as ordinary workmen, and reach such positions as foremen, designers, etc., only after years of labor. Of the 28 persons graduated from this school in 1895, 1896, and 1897, 27 obtained employment in the woodworking industry as journeymen.

STATE SCHOOL FOR CABINETMAKING, MARIANO.

This institution comprises a day trade school and an evening continuation school. The object of the institution is to give a theoretical and practical training in the cabinetmaking trade, to develop the existing cottage industry, and, by a thorough training of the younger generation, to increase the efficiency of the working population in the manufacture of marketable furniture.

In the day school the course of instruction covers four years. The theoretical instruction embraces the Italian and German languages, industrial arithmetic, free-hand drawing, geometry and geometrical drawing, geography and history, technology, industrial bookkeeping,

free-hand drawing from models, perspective, industrial drawing, and styles of ornamentation. Much attention is given to commercial instruction in order to enable the local cabinetmakers to look after their export trade without the use of middlemen or agents. Candidates for admission must have completed their common-school education and must be physically fitted for the industry. Tuition is free except to foreigners, who must pay 50 florins ($20.30) per year. Tools and other requisites are furnished free of charge to the pupils. The workshop has a capacity for 20 pupils. The term begins September 1 and closes July 15.

In the evening continuation school theoretical instruction is given to journeymen and apprentices of this industry. The instruction is divided into two courses and embraces the following subjects: Free-hand and constructive drawing, business forms, industrial arithmetic, bookkeeping, penmanship, economic lectures, and singing. Instruction is given on week days from 6 to 8 p. m. from October 1 to May 31.

The teaching personnel consists of a director, 3 instructors, and 2 foremen.

At the beginning of the school term 1899–1900, 93 pupils attended the school, of whom 1 was a special and 22 were regular pupils, and 70 attended the continuation school.

The 7 persons graduated from the day school in 1895, 1896, and 1897, all obtained employment as journeymen in the cabinetmaking industry at wages ranging from 1 to 2.50 florins ($0.41 to $1.02) per day. The trade school has been of assistance to the local cottage industry, both technically and commercially, by furnishing plans, drawings, designs, and models for furniture, etc., to local establishments.

STATE SCHOOL FOR WOOD TURNING, TACHAU.

This institution comprises a day trade school and an industrial continuation school. The purpose of the trade school is to give a thorough theoretical and practical training which will fit young men for the practice of the wood turner's trade. The theoretical instruction includes free-hand drawing, drawing from models, geometry and geometrical drawing, perspective, architectural styles, industrial drawing, technology, arithmetic, business forms, and bookkeeping. The practical work gives pupils a knowledge of the use of all the tools and apparatus employed in the turner's trade. The methods and operations of wood carving and cabinetmaking are also taught, but the capacity of the shop for such work is limited to four pupils. The courses of instruction in wood turning and in cabinetmaking cover three years and that in wood carving four years.

Candidates for admission to the trade school must be over 14 years of age, must have graduated from the common schools, and must have the physical fitness necessary for their respective trades. The school

term begins September 16 and closes July 31. No tuition of any kind is charged. Materials necessary for instruction are furnished free, and indigent deserving pupils are given monthly stipends of from 1 to 10 florins ($0.41 to $4.06) from a fund set aside for this purpose by the town government.

The general industrial continuation school is intended for apprentices and journeymen who can not attend the trade school and who wish to perfect themselves in certain theoretical branches. The course of instruction covers two years. In the first-year course are taught free-hand drawing, geometry and geometrical drawing, arithmetic, reading, and composition; in the second-year course, industrial drawing, arithmetic, business forms, and bookkeeping, with special reference to this industry. This school opens October 1 and closes April 30. In the first-year course instruction is given on Sundays from 9 a. m. to noon and on week days from 7 to 9 p. m.; in the second-year course from 9 a. m. to noon on Sundays and on three week days from 7.30 to 9 p. m. The instruction, as well as the necessary requisites, is furnished free. On account of the lack of accommodations admission to this school is limited, and instruction is usually given only to persons engaged in industries where a knowledge of drawing is necessary.

The school is under the management of a board of 10 members, most of whom are engaged in the woodworking industry of this locality. The teaching personnel consists of a director, 3 foremen, and 1 assistant instructor.

During the school term 1897–98 this institution received a subsidy of 50 gulden ($20.30) from the chamber of commerce of Eger for the industrial continuation school. A sum of 250 gulden ($102) was received from the ministry of education, 199.50 gulden ($81) from the school fund, and 20 gulden ($8.12) from the local savings bank for the aid of worthy pupils.

At the beginning of the school term 1899–1900 there were 14 pupils in attendance at this school. The 4 persons graduated in 1895, 1896, and 1897, all obtained employment as journeymen in wood-turning establishments at wages ranging from 6 to 12 florins ($2.44 to $4.87) per week.

STATE SCHOOL FOR WOODWORKING, VILLACH.

This school is an important one. It consists of a number of more or less independent schools or courses having for their purpose the imparting of technical instruction to different classes of the working population. It embraces a day trade school, consisting of a preparatory school of two years' work and a trade school of three years' work; a drawing course for boys attending the public schools; an open drawing hall for men; an open drawing hall for women; an industrial continuation school, consisting of a preparatory course

of two years and a regular course of two years; and a commercial school, consisting of a regular course of three years and a course for stenographers.

The day school is intended for young men who desire to learn the woodworking trades. It is so organized that it turns out graduates as fully fitted for the practice of the trades in which they have been receiving instruction as is possible in a trade school. Boys may enter the preparatory course at 12 years of age. After two years' work in this course they pass three years in the trade school proper, thus graduating at 17 years of age, or, as the director of the school says, when the transition from the school to business life is not a difficult one.

To enter the preparatory course candidates must be at least 12 years of age and must have passed a six years' public school course. For admission to the trade school proper they must have passed the preparatory course or a two years' course in an artisans' school, school of arts and sciences, or other institution which is in every respect up to the standard of the preparatory course. Deserving pupils receive scholarships. Free dinners and free tickets to the public kitchen are also given. Owing to the large number of applicants for admission a competitive examination determines the ones to be received.

The instruction given is both theoretical and practical, though much the greater part of the time of the pupils is devoted to the latter. Much attention is given to drawing in its application to the woodworking trades. In this way the pupil is prepared to become an independent journeyman, capable of designing as well as executing work. Different styles are taught in courses devoted to the history of art. The technical studies include instruction in machinery, small motors, the properties of wood, the establishment of working plants, the technology of woodworking, outlines of industrial hygiene, commercial accounts, etc. In the workshops the pupils are given a systematic training in all the practical work of their trade. In the preparatory course each pupil has exercises in cabinetmaking, wood turning, and carving, in order to make him acquainted with the rudiments of all branches of the woodworking trade. A definite choice of the particular occupation to be prepared for is not made until the pupil enters the trade school proper.

Besides the regular pupils the trade school permits apprentices, helpers, and masters in the small construction and art trades to attend the courses from 8 a. m. to noon and from 2 to 5 p. m. as special pupils. The courses open to them are those in geometrical, free-hand, and industrial drawing, planning and designing of industrial art and architectural objects, etc. These courses are well attended by carpenters and masons. Admission is free as far as accommodations permit.

The drawing course for boys attending public schools has as its pur-

pose the giving of a more thorough training in drawing than they can receive in their regular schools, and particularly instruction in drawing as applied to industry. These courses are held every Wednesday from 10 a. m. to noon throughout the year.

The open drawing hall for men furnishes a place to which directors of industrial establishments, graduates of the school, and others can resort to receive further instruction in drawing and designing. Instruction is free and is given from 9 a. m. to noon on Saturdays and from 7 to 9 p. m. on Wednesdays.

The open drawing hall for women is intended for those who desire instruction in drawing as an aid to their work.

The industrial continuation school is for the instruction of apprentices who are at work during the day. The instruction is theoretical, as the practical work is learned by the pupils in workshops. Attendance is compulsory upon all apprentices in the city except those in the bakery industry. The school is in session from 9 a. m. to noon on Sundays and from 7 to 9 p. m. on three week days. The commercial continuation school offers analogous supplemental instruction to commercial employees.

The trade school proper and the continuation school are under the management of separate governing boards, that of the former consisting of the mayor and 7 associates and that of the latter of the mayor and 9 associates. The corps of instructors for all the branches includes 22 members. The school is supported by the joint contributions of the State, the chamber of commerce, the savings bank, and commercial organizations. The following statement shows the number of pupils registered in each of the various branches of the school during the school term 1897–98:

	Pupils.
Day school:	
Preparatory course	33
Trade school proper	24
Special pupils	23
Drawing course for public-school boys	93
Open drawing hall for men	27
Open drawing hall for women	20
Industrial continuation school	162
Commercial continuation school	46
Total	428

At the beginning of the school term 1899–1900 there were 56 regular and 17 special day pupils, and 133 others, not including those who attended the continuation courses.

Of 24 persons who graduated from the day school in 1895, 1896, and 1897, all obtained employment in the woodworking industry as cabinetmakers, wood carvers, etc., at wages ranging from 7 to 12 florins ($2.84 to $4.87) per week.

STATE SCHOOL FOR WOODWORKING, WALLACHISCH MESERITSCH.

This school comprises a day trade school, an open drawing hall, a manual training school for pupils of the public schools, and an industrial drawing hall. The purpose of the day trade school is to educate pupils for the various woodworking trades by giving them a systematic training in theory and practice and imparting such a measure of efficiency as is demanded by the development of the modern woodworking industry. The instruction includes a preparatory course of one year, which is the same for all pupils, and a three or four years' course in a trade chosen by the pupil.

The woodworking trades taught at the school are carpentry and cabinetmaking, ornamental wood carving, figural wood carving, wood turning, and decorating and gilding. Each of these courses covers three years, except that in figural wood carving, which covers four years.

The theoretical instruction embraces general preparatory, technical, industrial-art, and commercial branches, special attention being given to drawing and styles of architecture and ornamentation. Instruction in drawing includes free-hand drawing from copy and models, geometrical drawing, perspective and shading, architectural drawing, and special trade drawing. By this means pupils are enabled to make drawings and original designs for work to be executed in wood. The technical instruction includes a study of the properties of wood and of the important materials used in connection with woodworking. The commercial branches include business forms, industrial arithmetic, bookkeeping, and business practice.

The greater part of the time of the pupils (63 per cent) is given to instruction in the workshop. In the preparatory course instruction is given in the use of tools and in the technical uses of wood. The work done is intended to prepare pupils for the trade courses. It also enables the pupils to choose the particular branch of woodworking which they are best adapted for. The special purpose of the workshop for carpentry and cabinetmaking is to perfect pupils in these trades. In this workshop much attention is given to the making of church fixtures such as altars, pulpits, etc., for which there is quite a demand in this locality. The instruction in the workshop for ornamental wood carving includes modeling, making and repairing plaster casts, exercises in the various styles of carving, such as round and hollow carving, furniture ornamentation, etc. Pupils in this course are also instructed in gilding and decorating, and in pyrography. The workshop for figural wood carving gives pupils an opportunity to perfect themselves in this work, especially in the execution of statues and figures for churches. In the wood-turning shop pupils are taught the execution of all styles of wood turning required in the furniture and carpentry trades, as well as in the manufacture of turned wooden ware and bone

and horn objects. In the workshop for decorating and gilding, special attention is given to the gilding and painting of statues, figures, and ornaments of all sorts used in churches. In general, the practical instruction in the workshops is intended to replace the private instruction received by apprentices working under masters, the school being better fitted to give the pupils a comprehensive knowledge in a shorter time.

This school does not prepare pupils to enter upon the higher positions, such as foremen, draftsmen, etc. It only undertakes to train them to become skilled workers in the woodworking trades. In the admission of pupils preference is given to sons of persons engaged in this industry. Candidates for admission must be graduates of the common schools and must have physical fitness for the trade to be learned. Candidates for admission to the trade courses must have passed through the preparatory school or a school giving a similar education. Special pupils are admitted according to the capacity of the school. The same conditions of admission apply in the case of special pupils as in that of regular pupils.

A matriculation fee of 1 gulden ($0.41) and a tuition fee of 12 gulden ($4.87) are charged. Indigent and worthy pupils are exempted from the payment of tuition, and other provision is made for them in the form of stipends, etc.

The open drawing hall for persons engaged in this industry is intended to bring this school into closer relations with the local industry. Advice and instruction is given concerning the execution of woodwork from drawings, objects, and models. Although this hall was originally intended for masters and journeymen, any adult may receive instruction there. Graduates of the trade and continuation schools are here given a special opportunity to perfect themselves in trade drawing. Instruction is given two hours on Sunday mornings during the entire school term, and two hours on Monday afternoons during the winter term only, a charge of 1 gulden ($0.41) being made for such instruction.

The course in manual training for pupils of the public schools is intended to give a general idea of the use of tools and to encourage a taste for manual labor. The pupils are not prepared here for any special trade.

The general industrial continuation school is intended to give apprentices in the handicraft trades such a general training, commercial education, and skill in drawing as is necessary in the every-day practice of their trades. For this reason the continuation school comprises a preparatory course, with instruction in reading, writing, arithmetic, and the elements of drawing, and a regular continuation course, with instruction in free-hand, geometrical, and industrial drawing, business forms, arithmetic, and bookkeeping. Instruction is given on Sundays

from 9 a. m. to noon, and on four week days from 6 to 8 p. m., beginning October 1 and ending July 30. No tuition fee is charged, but a matriculation fee of 1 gulden ($0.41) is required. Indigent pupils are exempted from the payment of this fee and are supplied with the necessary materials. All apprentices are compelled to attend this school. Owing to the limited time of instruction the training is very much restricted, and for this reason graduates of the school often continue their education by attending the open drawing hall.

The teaching personnel of the entire school consists of a director, 6 foremen, 5 trade instructors, and 8 assistant instructors.

During the school term 1897–98 the institution received subsidies for the industrial continuation courses amounting to 692 florins ($281) from the ministry of education, and 187 florins ($75.92) from the Chamber of Commerce and Industry of Olmutz, the local town government, and the local guilds. The sum of 1,730 florins ($702) was received from these and other institutions for scholarships, stipends, and other aid to worthy pupils.

At the beginning of the school term 1899–1900 256 pupils attended this institution, of whom 17 were attendants at the day school, 93 at the continuation school, and 88 at other classes.

Of the 31 persons graduated from the day school in 1895, 1896, and 1897 nearly all obtained employment as journeymen in woodworking establishments at wages ranging from 40 to 50 florins ($16.24 to $20.30) per month.

One of the principal objects of this institution is the advancement of the small industries of the locality. This object is attained by the execution of work in the shops of the school, the securing of orders for articles, executing sketches, plans, and specifications, giving advice on technical subjects, sources of materials used, etc. The usefulness of this school is not restricted to this town, but often extends to other localities.

STATE SCHOOL FOR WOOD AND IRON WORK, BRUCK a. d. MUR.

This institution consists of a day school, a drawing hall, and an industrial continuation school. The day school has workshops for carpentering and cabinetwork, wood turning, and locksmithing. It seeks to replace regular apprenticeships by giving a more theoretical and practical course of instruction than could be afforded in a private workshop. The theoretical instruction comprises a course in general education, drawing, and commercial branches. By means of the drawing course the pupils are taught in the preparation and execution of plans and drawings which apply to their respective trades. In the commercial course they are taught such branches as may be needful to them in their business as master workmen. Through practical instruction in the workshops the pupils are made familiar with all the

work by creative methods, styles of ornamentation, and in fact such high-class work as they could not learn in a private establishment.

In order to be admitted to the school, candidates must have completed their common-school education and must possess the physical fitness for learning the trade. No tuition fee is required, except a registration fee of 1 florin ($0.41). Foreigners must pay 25 florins ($10.15) for the half-year term. The utensils required in the workshops are furnished free to all pupils.

The course of instruction for the regular pupils is four years. Every pupil who successfully passes through this school receives a certificate entitling him to follow his trade as a journeyman or master. Experience has shown that pupils of ordinary intelligence and ambition, who possess the preliminary education required, can successfully pass through the school in the allotted time. Provision is made for worthy and needy pupils in the form of scholarships and other assistance. The drawing materials are furnished free to the pupils, and they receive special remuneration from the sale of objects made in the workshops. Reduced railroad rates are allowed pupils who attend this school. The school opens September 15 and closes July 31 of each year.

The free drawing hall has two divisions, one for men and one for women. In the former instruction is given to masters and journeymen and to apprentices who wish to perfect themselves in drawing. The classes are held on Sundays from 8 a. m. to noon, from October 15 to June 15 of each year. The drawing hall for women affords an opportunity to women to practice drawing such objects as are of material benefit to them in female handiwork. Instruction is given on week days from 8 a. m. to noon, from September 15 to July 31 of each year.

The industrial continuation school for males is intended for persons who are serving an apprenticeship. The subjects taught are reading, writing, industrial arithmetic, bookkeeping, and drawing. The course of instruction covers two years, the pupils finishing the course receiving a graduating certificate. The school is in session from October 15 to May 15 of each year.

This institution is under the control of the mayor of the city and seven curators, most of whom are persons engaged in manufacturing handicraft trades. The teaching personnel consists of a director and 11 teachers. The most cordial relations exist between the management of this school and the local manufacturers. The school receives a subsidy of 100 florins ($40.60) for the use of the continuation school. During the school year 1897–98, 506 florins ($205) were realized from the sale of the work executed by pupils in the workshops. This money was divided among the pupils.

The attendance of the school was 131 pupils at the beginning of the school year 1899–1900. Of these, 40 attended the day school, 42 the

continuation school, and 49 the other classes. The 22 persons graduated from the school in 1895, 1896, and 1897, all obtained employment as journeymen in workshops of the wood and iron working industry at good daily wages.

STATE SCHOOL FOR STONECUTTING, LAAS.

This school, in Tyrol, was founded for the purpose of aiding in the development of the local marble industry and to train young persons of this locality for that class of work. The school includes a day trade school and a drawing school for pupils of the public schools.

The day school has two divisions, one for stone carving and one for stonecutting. The former course covers five years and the latter four years. Theoretical and practical instruction is given in both courses. The theoretical instruction consists mainly of drawing and modeling, commercial branches, and the necessary technical knowledge for this industry. The greater portion of the time is devoted to practical work, so that the pupils may enter directly upon their trades when they graduate, even though a further training in drawing and modeling may be desirable.

The school term begins October 1 and closes August 15. During vacation time, from August 15 to September 1, additional instruction is given in the workshop. Tuition fees are required for foreign pupils only. The number of regular pupils is limited to 20. Stipends and other aid is provided for indigent and worthy pupils. Drawing paper and tools are furnished by the school. Special pupils are admitted to the theoretical instruction classes whenever the capacity of the school permits.

The drawing course for pupils of the common schools is intended for boys who wish to enter upon the marble industry. Instruction is given from 8.30 to 11 a. m., on Thursdays, from October 15 to April 30.

The management of this institution is in the hands of a board of 10 members. The teaching personnel consists of the director, 2 trade instructors, 2 foremen, and 1 assistant instructor. The school received a subsidy of 80 florins ($32.48) from the chamber of commerce of Bozen for fuel and light. The sum of 150 florins ($60.90) was received from the ministry of education, and 220 florins ($89.32) from other sources for stipends and other aid to pupils.

The attendance at the school was 26 pupils at the beginning of the school term 1899–1900, of whom 19 were regular and 7 special pupils. Of the 13 persons graduated from this school in 1895, 1896, and 1897, 10 obtained employment in the stone-working industry as stone carvers and journeymen stonecutters, at wages ranging from 10 to 15 florins ($4.06 to $6.09) and from 8 to 12 florins ($3.25 to $4.87) per week, respectively.

Schools for Earthenware and Glasswork.

STATE MODELING SCHOOL FOR CERAMIC AND RELATED INDUSTRIES, OBERLEUTENSDORF.

This institution embraces a day trade school and a general industrial continuation school. The purpose of the day trade school is to give a thorough education in ornamental and figural modeling, together with such a practical and theoretical training as will fit pupils to practice the trade of modeler. The principal subjects taught are drawing and modeling in ornamental as well as figural work in majolica and terra cotta and the application of drawing and modeling to stone and stucco work and metal casting. Three years are required to complete the course, but in many cases a fourth year's attendance is necessary.

The instruction in drawing consists of free-hand and geometrical drawing, drawing from plaster casts in chalk and charcoal, India ink and colors, figural and anatomical drawing from plaster casts, and trade drawing, mostly of earthenware objects. The modeling work begins with the simplest forms in order that pupils may familiarize themselves with the use of tools and materials. This is followed by modeling ornaments of various kinds, instruction being given in styles of ornamentation and their characteristics. Finally the application of modeling to practical work is taught. The figural modeling begins with the reproduction of parts of the human body, followed by the modeling of anatomical and other bodies from casts and from photographs. The practical work embraces modeling, casting, retouching, making models for reproduction in plaster, and turning on the potter's wheel. The theoretical subjects taught are arithmetic, business forms, and bookkeeping. These are taught three times per week, from 6 to 9 p. m., in connection with the continuation school. The drawing and composition books and other requisites are furnished free to all pupils, and text-books also to those who can not afford to furnish them.

Candidates for admission to this school must have the necessary physical and mental fitness, must be over 14 years of age, and must be graduates of the common schools. No fees of any kind are required except from foreigners, who pay a tuition of 30 florins ($12.18) per half-year term. Special pupils are admitted to the day school for the purpose of perfecting themselves in drawing and modeling. They pay no fees for attendance.

In the general industrial continuation school the course covers three years. All apprentices both of handicraftsmen and of merchants are required to attend these classes. No apprenticeship term is completed until the apprentice has obtained a graduation certificate from this school. The instruction is given on three days of the week from 6 to 9 p. m., and on Sundays from 9 a. m. to noon. The school opens September 16 and closes July 31. The subjects taught are industrial arithmetic, business forms, bookkeeping, free-hand and geometrical

drawing, perspective, and industrial drawing. The necessary requisites are supplied to pupils, and no tuition fees are charged.

The managing board of the day and continuation schools consists of the mayor and 4 associates. The teaching personnel consists of the director and 4 instructors.

At the beginning of the school term 1899–1900, 22 pupils attended the day school, of whom 3 were special pupils. The number of attendants at the continuation school during this year is not known, but 132 matriculated in 1897.

The large earthenware manufactory in this city was founded in 1897 by a former graduate of this school. Aside from this, Oberleutensdorf has no workshops in which modeling may be practically applied. The school, however, stands in close relation with the manufacturers of neighboring towns, and much aid is given them in the form of models, drawings, and technical advice. The 20 persons graduated from the day school in 1895, 1896, and 1897 obtained employment as designers and modelers in ceramic establishments at wages ranging from 40 to 80 florins ($16.24 to $32.48) per month.

STATE SCHOOL FOR THE EARTHENWARE INDUSTRY, TEPLITZ.

The purpose of this institution is to offer to young persons wishing to enter the earthenware industry an opportunity to obtain the necessary theoretical and practical training and to develop a superior artistic taste. Persons adopting other industrial art occupations may also be admitted, but the instruction of the school is mainly directed toward the earthenware industry. The school also aims to improve the quality of the earthenware made in its vicinity by giving free instruction, loaning working models, drawings, books, etc., and giving advice about sources, prices, etc., to local manufacturers. This close relation with the business interests exists not only in the case of the earthenware but also of all other art industries. The institution embraces a day trade school, an open drawing, modeling, and painting hall, and an evening and Sunday course in drawing, modeling, and painting.

The day trade school instruction includes classes in drawing, modeling, painting, and chemistry. The first year is a preparatory course, the second and third years constituting the regular trade course. The preparatory course is intended to give pupils the necessary training in drawing, modeling, and painting, and to fit them to enter the trade course.

The instruction includes elementary free-hand drawing from simple ornaments and from objects and models, modeling objects in clay, and the elements of technical drawing and geometry, as far as these are necessary in the earthenware industry; the simplest elements of aquarelle and enamel work, by which pupils obtain an idea of colors and their mixture, the uses of painting utensils, and flower painting. Exer-

cises in calligraphy, including various styles of ornamental lettering, are also given. The instruction in chemistry relates to the important metals and metalloids used in the ceramic industry, their compounds, signs, and formulas, and the most important elements of organic chemistry. The instruction in physics, mineralogy, and botany also has special reference to the ceramic industry.

Candidates for admission must be 14 years of age and must be graduates of the common schools. Special pupils are admitted to the day school for the purpose of taking up individual branches of study. Handicraftsmen in the building trades, such as masons, carpenters, etc., attend during the winter months only, some during the daytime and others on evenings and Sundays. Scholarships are provided for needy and industrious pupils. Books and other requisites are also furnished in such cases. Tuition is free except for foreigners, who pay a fee of 50 florins ($20.30) per year. The school term begins September 16 and ends July 31.

The drawing, modeling, and painting hall was opened as a separate division of the school on October 1, 1887. Instruction is given free on four days of the week in free-hand and industrial drawing, modeling, and painting. The main purpose of this hall is to offer opportunities for instruction to masters and journeymen who are already practicing in this industry. The number of pupils is limited.

The evening and Sunday school connected with this institution is intended to give apprentices and journeymen such instruction in drawing, modeling, and painting as will be of service to them in their respective trades. The greater number of these pupils are employed in earthenware establishments in this locality. Instruction is given on Sundays from 9 a. m. to noon, and on Tuesdays and Thursdays from 7 to 9 p. m., no tuition fee being charged. The school opens October 1 and closes April 30.

The management of the entire institution is in the hands of a board consisting of the mayor and 6 associates. The teaching personnel consists of a director, 6 trade instructors, 3 foremen, and 1 assistant instructor.

During the school term 1897–98 a subsidy of 50 florins ($20.30) was received from the Chamber of Commerce in Reichenberg. Besides this, 773 florins ($314) were received from other sources for stipends and assistance of various kinds to pupils. During this term a number of excursions were made to various manufacturing establishments, under the guidance of the instructors.

At the beginning of the school term 1899–1900 193 pupils attended the school, of whom 54 were regular and 6 were special pupils; 128 attended the Sunday and evening classes, and 5 attended other courses.

Graduates do not, as a rule, obtain important positions when leaving this trade school, and if they do it is usually because they had previous

practical experience. The 52 persons graduated from the day school in 1895, 1896, and 1897, obtained employment in earthenware establishments as journeymen at wages ranging from 6 to 8 florins ($2.44 to $3.25) per week, and 40 to 70 florins ($16.24 to $28.42) per month.

STATE SCHOOL FOR THE EARTHENWARE INDUSTRY, ZNAIM.

This school embraces a day trade school, an open drawing hall for men, an open drawing hall for women, and an industrial continuation school.

The day school aims to train pupils in the work of the earthenware industry. It is intended for graduates of the common, grammar, manual training, or the lower classes of intermediate schools. The regular course covers three years, but pupils who wish to obtain a further training in chemistry, modeling, painting, etc., may continue to attend a fourth year, and, with the permission of the ministry of education, a fifth year. The school opens September 16 and closes July 31. Both regular and special pupils are admitted, special pupils being either graduates of this school who wish to obtain a further training in certain lines, or persons engaged in practice who wish to perfect themselves in certain branches of their work.

The subjects taught are as follows: First year—Religion, languages, geometry, geometrical drawing, arithmetic, physics, calligraphy, free-hand drawing, modeling, and turning. Second year—Religion, industrial arithmetic, correspondence, inorganic chemistry, perspective, stereometry, form and heraldic design, free-hand drawing, modeling, turning and molding or ceramic painting. Third year—Religion, industrial correspondence, bookkeeping, inorganic chemistry, ceramics, industrial chemistry, perspective, industrial drawing, modeling, and execution of practical work from patterns.

The open drawing hall for men is intended to give persons engaged in the earthenware industry and graduates of this school an opportunity to perfect themselves in free hand and industrial drawing, in making sketches, and in preparing plans of objects to be executed. It is open from October 1 to July 15.

The open drawing hall for women serves a similar purpose to the preceding, being intended to give girls who have completed their common-school education an opportunity to practice such drawing as may be useful to them in their occupations. It also opens October 1 and closes July 15.

The general industrial continuation school is intended to give apprentices such theoretical and practical training as will be of benefit to them and will increase their efficiency as workmen in the handicraft trades. The school also educates journeymen and strives to develop their taste for art in this industry. The school opens October 1 and closes May 31.

The management of the entire institution is in the hands of a board consisting of the mayor and 5 associates. The teaching personnel

consists of a director, 7 trade instructors, 7 assistant instructors, and 2 foremen.

During the school term 1897–98 the school received 350 florins ($142) from the ministry of education and 2,254 florins ($915) from other sources for scholarships, stipends, and other aid to pupils.

At the beginning of the school term 1899–1900 there were 190 pupils at this school, of whom 50 were regular and 6 special day pupils; 112 attended the continuation school and 22 attended other courses.

This institution is also of assistance to the local manufacturers by preparing patterns and models for their use, and by making chemical and technical tests and researches.

STATE SCHOOL FOR THE GLASS INDUSTRY, HAIDA.

This institution embraces a day trade school, a Sunday school, an open drawing hall, and a drawing course for pupils of the common schools.

The day school is intended to give the necessary instruction to persons desiring to become glass stainers, engravers, and etchers in the various branches of the glassworking industry. The course covers four years and is open to persons who have been graduated from the public schools. Pupils may be graduated at the end of three years, but experience has shown that in order to be thoroughly competent a four years' attendance is necessary. The school opens September 16 and closes July 31.

The theoretical instruction of the day school comprises general educational, technical, and commercial branches, including drawing. The latter, to which special emphasis is given, comprises free-hand, technical, and industrial drawing. The regular practical instruction is carried on simultaneously with the theoretical work. The commercial course comprises the most important business forms, arithmetic, and bookkeeping.

The plan of instruction of the day school is as follows: First year—Elements of free-hand drawing, geometrical drawing, physics, chemistry, commercial arithmetic, business forms, writing, and practical work. Second year—Free-hand drawing from models, study of perspective, shading, form, heraldic design, industrial drawing, decorative painting, modeling, technology, chemical laboratory work, commercial arithmetic, business forms, and practical work. Third year—Free-hand drawing from models, industrial drawing, decorative painting, modeling, chemical laboratory work, industrial bookkeeping, and practical work. Fourth year—Industrial drawing and practical work.

The day school has regular and special pupils, the former being those who wish to take regular courses and the latter those who take only certain subjects or who wish to obtain a better practical training.

The Sunday school is designed for journeymen and apprentices who receive instruction on Sundays from 9 to 11 a. m., beginning the first Sunday after September 16 and ending the last Sunday in May. The

subjects taught are free-hand and industrial drawing and decorative painting.

The drawing hall is open during three forenoons of each week to persons engaged in the glassworking industry. Its purpose is to offer facilities for further development in drawing and in the execution of working plans. This hall is especially adapted to the further training of graduates of the day trade school.

The drawing course for pupils of the common schools is intended for pupils of the higher classes. They receive instruction in elementary free-hand drawing on Saturdays and Sundays from 2 to 4 p. m.

The management of the school is intrusted to a board consisting of the mayor of Haida and 7 associates, most of whom are persons engaged in this industry. The teaching personnel comprises a director, 7 trade instructors, 1 foreman, and 1 assistant instructor.

The industrial continuation school at Falkenau, which is under the supervision of the director of the trade school at Haida, is intended to give glassworkers, such as stainers, engravers, etc., an opportunity to obtain a further knowledge of drawing and instruction in mercantile branches. The management of this school is in the hands of a board consisting of the mayor of Falkenau and 8 associates. The school has 2 instructors. The term begins September 1 and closes June 30.

The trade school at Haida renders assistance to the local industries by executing patterns, designs, etc., giving advice, and placing its library and models at the disposal of local manufacturers.

During 1898 the institution at Haida received 894 florins ($363) from the ministry of education and from other sources for aid to indigent and worthy pupils. In addition to this the ministry of education made provision for two stipends of 180 florins ($73.08) each and one of 150 florins ($60.90), and various organizations contributed smaller sums.

During the school term 1899–1900, 195 pupils attended the school at Haida. Of these 31 were regular and 5 were special day pupils, and 159 attended the continuation and other courses. Of 16 persons graduated from the day school in 1895, 1896, and 1897, 13 obtained employment in the glass industry as designers and glass engravers at wages ranging from 20 to 60 florins ($8.12 to $24.36) per month.

STATE SCHOOL FOR THE GLASS INDUSTRY, STEIN SCHÖNAU.

This institution embraces an industrial art school, a drawing course for pupils of the public schools, a special course in chemistry, an open drawing hall, and a trade continuation school.

The object of the industrial art school is to educate designers and painters in the hollow glassware and porcelain industries by giving them, by means of systematic theoretical and practical instruction, a

higher degree of efficiency in their art than they could obtain in ordinary practice. The course of instruction covers three years, although pupils may continue for a fourth year if they desire to do so.

The theoretical instruction includes a thorough training in drawing, painting, elementary instruction in form and in heraldic design, and general educational, technical, industrial art, and commercial branches. The instruction in drawing comprises elementary drawing, drawing from models, drawing and painting from nature, such as animals, plants, etc., geometry, perspective, and shading. Much attention is given to a proper development of taste in form and ornamentation and in the matching of colors and the applications of various styles of ceramic art, so that pupils may be enabled in actual practice to execute work from sketches or objects and to design glass and porcelain ware. The technological subjects include the fundamental principles of chemistry and chemical properties of materials used in this industry, such as glass, porcelain, china, etc., etching, and preparing enamel and metallic colors. In the commercial instruction pupils are taught such business forms and practices as may be of value to them in the practice of their trades.

The greatest importance is given to practical instruction, so that pupils may learn the methods of work and decoration which are required in actual practice. The instruction during the first and part of the second year in glass engraving and decorating is confined to work especially designed to develop their skill, after which the pupils take up marketable objects. The greatest stress is laid upon accurate, substantial work.

Candidates for admission to this industrial-art school must have been graduated from the common schools, and preference is given to sons of persons engaged in this industry. During the school term 1897–98, 80 per cent of the pupils were sons of such persons. Pupils are required to attend the school regularly. Needy and worthy pupils receive stipends of from 20 to 100 florins ($8.12 to $40.60), according to their needs and scholarship. Instruction is free, but foreigners are required to pay a tuition of 50 florins ($20.30) per school term. The school opens September 16 and closes July 31. Upon completing their course of study pupils receive graduation certificates which entitle them to practice their respective trades. Apprentices, journeymen, and designers of related industries may be admitted to this school as special pupils in order to perfect themselves in certain lines of work. There is no specified period of instruction for special pupils, although they must, when entering the school, designate the subjects that they wish to take and the hours they intend to devote to each, and they are required to attend accordingly.

The drawing course for pupils of the common schools covers one year, and is intended to give them a better knowledge of drawing than

it is possible to obtain in the common schools. Pupils of the higher classes of the common schools are admitted, but only so many as the capacity of the school permits. The course begins September 16 and closes July 15. Instruction is given on Thursdays from 9 a. m. to noon and from 1.30 to 3.30 p. m., and is gratuitous.

The special course in chemistry gives to persons engaged in the glass and metal industries and to pupils attending school an opportunity to become acquainted with the fundamental principles of chemistry, the principal chemical elements and combinations, and the methods of decorating, staining, coloring, etc., used in the glass and metal industries. The instruction given is both theoretical and practical. These lectures are given every Thursday from 7.30 to 8.30 p. m. from March 1 to July 15. No tuition is charged.

The open drawing hall, which stands in close relation with the local industries, is intended for masters and journeymen and any other adults who wish to obtain instruction or practice in drawing, modeling, and designing for their particular occupations. Instruction is given from 9 a. m. to noon on Mondays and Wednesdays during the regular school term. No fees are charged.

The trade continuation school gives such theoretical and practical instruction to apprentices and journeymen as is useful to them in the practice of their trades. Instruction is given fourteen hours per week, and comprises the following subjects: Course for apprentices—First year, elementary free-hand drawing, industrial arithmetic, and business forms; second year, free-hand drawing from models, decorative painting, industrial drawing, arithmetic, business forms, and bookkeeping. Course for masters and journeymen: Decorative painting, figural and industrial painting. Three years are usually required to complete these courses, the first being intended as a preparatory school for pupils who have had no training in drawing. In the course for apprentices instruction is given from September 16 to July 15 each Monday, Wednesday, and Sunday from 9 a. m. to noon and from 7 to 8 p. m., and in the course for masters and journeymen from October 1 to March 31 each Sunday from 9 a. m. to noon. No tuition fees are charged.

The teaching personnel consists of a director, 4 trade instructors, 2 foremen, and 1 assistant instructor. During the year 1898 the school received for use as stipends and other aid to needy pupils the sum of 390 florins ($122) from the ministry of education and 399 florins ($162) from various other sources.

There were 189 pupils in attendance at the school at the beginning of the school year 1899-1900, of whom 18 attended the day classes as regular and 9 as special pupils, 88 attended the industrial continuation school, and 74 the other classes. Of 21 persons graduated from the day school in 1895, 1896, and 1897, 18 obtained employment in glass

works as designers, glass stainers, and glass engravers at wages ranging from 6 to 15 florins ($2.44 to $6.09) per week.

The chief purpose of the trade school is to elevate industrial art not only by the training of skilled workmen, but by advancing in every way the smaller industries. In this way the service of the school extends not only to those engaged in the glass industry, but also to stonecutters, bronze workers, decorators, fancy wrought-iron workers, cabinetmakers, etc.

Schools for Metal Working.

STATE SCHOOL FOR MACHINE CONSTRUCTION, KLAGENFURTH.

This is a day school which prepares young men to become efficient workmen in all the branches of the machine construction industry. In order to be admitted candidates must be over 14 years of age, must be physically strong, and must have successfully passed through the common schools. Special pupils are admitted if the capacity of the school permits. The tuition for the regular pupils is 10 florins ($4.06) per term. No tuition is charged for persons of small means. Foreigners must pay a fee of 25 florins ($10.15). Special pupils pay 3 florins ($1.22) per month. The school opens September 15 and closes July 31. Examinations for admission are severe, preference being given to persons who have had some practical experience in the workshop or some other school, and to sons of owners of manufacturing establishments. The matriculation fee is 50 kreutzers ($0.20).

The instruction is theoretical and practical, and the course covers three years. The theoretical instruction comprises general educational, technical, and commercial branches and drawing. The practical instruction includes all forms of machine construction work and engine and boiler tending. During the first year the pupils are taught simple file work and lock and key making, metal turning, drilling, thread and screw cutting, tool making, pattern making, to assist at forge work, and to tend steam engines. The work during the second year is similar to the preceding, except that it is more difficult and complicated. During the third year pupils are taught the actual work of machine construction, such as the making of lathes, drilling machines, etc., together with engine tending and pattern making. Pupils are also taken to manufacturing establishments in order to see practical work in this industry.

Pupils completing their three-year course receive certificates which entitle them to all the privileges of journeymen and master workmen. Whenever they are found to be physically or mentally unfit to continue their course, they are dismissed from the school, in which case they receive a certificate of attendance such as is given to special pupils.

In addition to the regular course mentioned above, a special course is given during the months of February and March to persons wishing to prepare for the engineers' and boiler tenders' examinations. Instruction in these courses is free and is given from 6 to 7 p. m. on week days.

The teaching personnel consists of a director, a technical instructor, 6 foremen and 2 assistant foremen of workshops, and 5 teachers. Subsidies amounting to 2,360 florins ($958) were received from the state and provincial governments and from the provincial savings bank for the aid of needy pupils.

The attendance at the beginning of the school term 1899–1900 was 205, of whom 87 were regular day pupils, 27 attended a special course in boiler and engine tending, and 91 attended the continuation courses.

Of 63 persons graduated in 1895, 1896, and 1897, 57 found employment in machine construction establishments as journeymen, draftsmen, and assistant foremen, at wages ranging from 35 to 125 florins ($14.21 to $50.75) per month in the beginning. After some practical experience these graduates received wages ranging from 1,800 to 2,400 florins ($740 to $974) per year.

STATE SCHOOL FOR LOCKSMITHING, SWIATNIKI.

The object of this school is to educate persons as practical locksmiths and to further the interests of the locksmithing industry in the locality. The school comprises a day trade school with a four years' course. Both regular and special pupils are admitted, the latter receiving instruction in any special branch of this industry. Pupils after being graduated usually enter the locksmithing industry as journeymen, and their superior intelligence and knowledge soon lift them above the ordinary workman to fill positions as foremen or managers.

The course comprises theoretical and practical instruction, sixteen hours per week being devoted to the former and thirty-two hours per week to the latter.

The theoretical instruction embraces general educational, technical, and commercial branches. The general educational instruction embraces religion, German and Polish languages, arithmetic, general business principles, and penmanship. The technical subjects embrace free-hand drawing from objects and models, geometrical drawing, including perspective and shading, and trade drawing, which also includes the designing of simple objects. This drawing instruction is intended to enable pupils to fill positions as draftsmen when required to do so, and to make correct working drawings from sketches executed by themselves. The technical branches also include physics, chemistry, and technology to such an extent as is necessary for a correct understanding of the various objects and materials met with in

this industry. In the commercial branches pupils are taught the important business forms, industrial calculations, and the fundamental principles of elementary bookkeeping.

The greater part of the time is devoted to practical instruction in the workshop. This comprises principally the working of iron and steel and such other metals and woodwork as may be necessary to familiarize the pupil with the manipulation and properties of all materials which are handled in the locksmith's trade. The pupils are also taught the use of machinery and tools used in this industry.

Candidates for admission as regular pupils must be graduates of the common schools, must be over 13 years of age, and must be physically fitted for the locksmith's trade. Pupils who have had previous training may enter a class above that of the first year. Preference is given to sons of persons engaged in the local locksmithing industry, the percentage of such pupils in 1898 being 25. No tuition is charged except to foreigners. A matriculation fee of 2 florins (81 cents) is required in order to defray the expenses of school requisites, which are furnished pupils free of charge. Provision is also made for worthy and needy pupils. Special pupils must pay a fee for the use of tools and machines.

The school management consists of a board of 9 members. The teaching personnel comprises a director, 1 instructor, 7 foremen, and 2 assistant foremen.

At the end of the school term 1896–97, 7 pupils were graduated from the day school.

This school assists the local industry by placing its machines at the disposal of persons engaged in this handicraft. This service is of especial benefit in view of the fact that not a single motor or power machine has thus far been used in the locksmithing industry outside the school. This school also endeavors to raise the standard and quality of the articles made in this locality by making tests and securing new tools by which articles may be made with less expense and without injury to their quality.

For the year 1897–98 the school received for the aid of worthy and needy pupils 400 florins ($162) from the ministry of education, 1,030 florins ($418) from the provincial council, and 855 florins ($347) from other sources.

At the beginning of the school term 1899–1900 there were 63 pupils in attendance at this school, of whom 62 took the regular and 1 the special course.

Of 16 pupils graduated from this school in 1895, 1896, and 1897, 1 is a foreman in the workshop of this school and the others are either owners of or skilled employees in house and lock smithing establishments. Those working for wages earned from 1.10 to 1.30 florins (45 to 53 cents) per day.

STATE SCHOOL FOR IRON AND STEEL WORK, FULPMES.

The purpose of this school is to prepare trained workers in such occupations relating to metal working as those of machinists, cutlers, and tool makers. It is especially intended to meet the needs of those expecting to work in their own homes or in small shops. Like many other schools, there are two distinct departments, the one consisting of courses given during the day and constituting the trade school proper and the other of evening courses intended for young apprentices who are compelled to work during the daytime. The latter is essentially a continuation school.

The day school comprehends three years of instruction. This instruction is both theoretical and practical. A great deal of attention is paid to drawing and the training of the pupils in the making of sketches and working plans, as well as in their interpretation. The more technical courses relate to mechanics, machinery, transmission of power, character of materials, etc. Attention is also given to the commercial aspects of the different trades. Every effort is made to impress upon the pupil the necessity for exactness and the following of correct methods rather than mere dexterity. He is instructed in the use of the latest devices and patterns and in recent progress of the trade.

Besides the regular pupils, special pupils may attend such courses as they desire. The evening courses are entirely theoretical. The most important subject taught is drawing.

The school has only recently been established, and it is too early to estimate results. The number of pupils registered in 1899–1900 was 19 in the day courses and 37 in the evening or continuation course.

STATE SCHOOL FOR THE IRON AND STEEL INDUSTRY, STEYER.

This institution embraces a day trade school, an industrial continuation school, and a special course for boiler tenders and engineers.

The day trade school trains young men in the cutlery and tool-making trades by giving them a methodical, theoretical, and practical education. The course covers three years of ten months each. Instruction is given daily, except on holidays and Sundays, from 8 a. m. to noon and from 1.30 to 6 p. m. Both regular and special pupils are admitted. Regular pupils must be at least 14 years of age, must be physically fitted for this trade, and must have graduated from the common schools. A tuition fee of 5 florins ($2.03) is charged. Needy industrious pupils are exempted from the payment of this fee. The pupils must supply the requisites for the theoretical instruction, but the tools and materials for the practical work are furnished by the school. The articles made in the workshops are the property of the school, but they may be bought by the pupils at the close of the year at the actual

cost price. Upon completing the three years' course regular pupils are given certificates of graduation. Special pupils obtain certificates of attendance.

The industrial continuation school for journeymen is intended to give persons who are employed during the day such instruction in drawing and commercial branches as may be useful to them in the practice of their trade. The instruction is given in two courses of seven months each, beginning October 1 and ending April 30, the classes being in session on week days from 7 to 8 p. m. and on Sundays from 8 to 11 a. m. The subjects taught are industrial arithmetic, bookkeeping, correspondence, penmanship, and geometrical, free-hand, and industrial drawing. In order to be admitted pupils must have attended the common schools, and must have served an apprenticeship. A tuition fee of 1 florin ($0.41) per term and a matriculation fee of 50 kreutzers ($0.20) are required. Pupils without means are exempted from the payment of these fees and are also furnished with the drawing materials. Certificates are given to graduates of the continuation school.

The special course for boiler tenders and enginemen is given on Sundays from 2 to 4 p. m., from October 1 to February 28. A tuition fee of 1 florin ($0.41) is charged. Graduates receive certificates showing the result of their work and conduct while in attendance at the school.

The management of the entire institution is in the hands of a board consisting of the mayor of Steyer and 7 associates. The teaching personnel consists of a director, 4 trade instructors, 2 assistant instructors, 3 foremen, and 1 assistant foreman.

During the year 1898 the school received 600 florins ($244) from the ministry of education and 1,760 florins ($715) from other sources for scholarships, stipends, etc.

At the beginning of the school term 1899–1900 there were 61 regular pupils and 1 special pupil in attendance at the day trade school, the number attending the other courses not being reported. At the beginning of the preceding year there were 66 regular day pupils and 88 pupils attending the continuation school and the boiler tenders and enginemen's course.

The 44 persons graduated from the day trade school in 1895, 1896, and 1897 obtained employment as journeymen in iron and steel working establishments at wages ranging from 9 florins ($3.65) per week to 100 florins ($40.60) per month.

STATE SCHOOL FOR FIREARMS MAKING, FERLACH.

The making of firearms, especially those for sporting purposes, seems to be an industry in which it is very much desired that the workmen should have a thorough training in the fundamental principles of the trade, as well as to have their artistic faculties developed.

In few trades, therefore, have special trade schools been of more service. In Austria the school at Ferlach has been fairly successful in meeting these various requirements. The school gives instruction in all the branches of the industry. It is organized in four departments—one for the making of all the ironwork of sporting guns; one for gunlock making; one for stock making, carving, and wood turning; and one for engraving, etching, and inlaid work.

Each of the four departments requires three years of study. The youth who enters at the minimum age (14 years) is thus enabled to begin work at 17 years of age. The purpose of the school is declared to be to create a body of workingmen who possess a full theoretical knowledge of the industry as well as practical skill in one particular branch. This, the report of the school says, is sought to be accomplished by (1) thorough practical instruction in the workshops under competent masters; (2) thorough instruction in the technology of arms, so that the pupil may become familiar from a theoretical standpoint with all matters involved in the making and use of firearms; (3) thorough instruction in trade and free-hand drawing and modeling, so that original construction work can be done; (4) thorough instruction in commercial matters, permitting the pupil to obtain the best results from his knowledge; and (5) to raise the general level of the workingmen by providing a small library where they can find the means for general education and culture.

During the winter term the hours of instruction are from 8 a. m. to noon and from 1 to 6 p. m., and during the summer term from 7 a. m. to noon and from 1.30 to 6 p. m. The yearly tuition fee is 10 florins ($4.06) for those residing in the district and 60 florins ($24.36) for others. Instruction is given by 10 teachers.

In spite of the apparently excellent ideas governing the work and organization of this school, it has not met with a very great recognition on the part of employers of the district or of the classes to be benefited. Thus the number of pupils registered in 1899–1900 was but 27. The reason for this lack of support seems to lie with the employers, who are not prepared to adopt modern methods. There is apparently a greater need for the education of the employer than for that of the employee. The following statement of the director of the school is interesting as showing the difficulties that a trade school has to contend with where industry is in a backward condition. He says:

Though the beneficial influence of the school in the district has been manifest in a number of instances, wherein graduates have profited by the instruction, this is only in exceptional cases, as where the graduate owns his business or where he has a certain influence with his employer. The greater part of the good work of the school goes astray, not finding the proper conditions under which to develop. The graduate, as

a rule, enters as a journeyman in some small local shop for gun making, where he finds opportunities for only a one-sided employment. What good does the instruction he has received here do him when, instead of having modern tools and appliances to deal with, he is forced to use slow contrivances long antiquated? The employer, however, looks more favorably upon the workman who comes from a competing shop and has gained a skill in a clumsy way, whereas the trade-school graduate is looked upon as having all sorts of useless information. * * * Furthermore, as the employers are constantly on the lookout for the more capable young men as apprentices, and the parents are anxious to be rid of the care and the support of their boys as soon as possible, the attendance of the school is a small one and is composed of inferior material, both physically and mentally.

The director then adds that fortunately this condition of affairs is gradually improving as the possible benefits of the school make themselves known.

STATE SCHOOL FOR THE METAL INDUSTRY, NIXDORF.

This institution comprises a day trade school, an open drawing hall, an industrial continuation school, and a drawing course for pupils of the common schools.

The object of the day trade school is the training of thoroughly qualified handicraftsmen for the local metal industry, particularly the cutlery and metallic button making trades. By means of systematic, theoretical, and practical instruction it aims to develop a high degree of skill in the execution of improved, neatly finished, and artistic work. The course of instruction covers three years. The school opens September 16 and closes July 31. Graduates of the common schools are admitted. Tuition is free, and the tools and requisites are supplied by the school, but pupils who are able must supply their own drawing materials. The school admits regular and special pupils.

The theoretical instruction embraces free-hand, geometrical, figural, and industrial drawing, drawing from models, perspective and shading, geometry, calligraphy, industrial arithmetic, business forms, and bookkeeping. The drawing instruction enables pupils to work from drawings and plans and to obtain a good foundation for the practical shopwork. The instruction in the commercial branches acquaints pupils with business forms and practices. The exercises in modeling are intended to teach pupils the fundamental principles of form and to enable them to execute such work in plaster as they may have occasion to perform in their occupations.

The practical instruction embraces such technical work as is performed in the metal trade of Nixdorf. Pupils are taught surface engraving, engraving for enamel and inlaid work, letter engraving, to make steel dies and stamps, and to execute enamel and inlaid work. Attention is also given to etching, coloring, and painting on metals,

wood, and horn, and electrotyping. Special pupils may be admitted for the purpose of taking up certain individual branches of study. They are usually persons of mature age, who wish to perfect themselves in certain branches of their work.

The open drawing hall is intended to give persons engaged in the industries of Nixdorf an education in drawing and industrial art work, the drawings, models, and patterns of the trade school being at their disposal. No tuition is charged, but the materials used have to be furnished by those who attend. A section of the open drawing hall is used for a drawing course for girls. This course is intended to give embroidery workers such a knowledge of drawing as will enable them to design their own patterns.

The purpose of the industrial continuation school is to give to apprentices a theoretical and, as far as possible, a practical training in such industrial art, technical, and commercial branches as they may utilize in their trades. This school comprises a preparatory class, two advanced classes, and a special course in drawing. The subjects taught are elementary free-hand, geometrical, and industrial drawing, reading, arithmetic, business forms, and bookkeeping. Instruction is given on week days, except Saturdays, from 7 to 9 p. m., and on Sundays from 9 a. m. to noon. The school opens September 15 and closes May 15. No tuition fee is charged, but each pupil must pay 1 gulden ($0.41) for school supplies.

The drawing course for pupils of the common schools is intended to give such pupils instruction in drawing which they can utilize in their future vocations. Instruction is given free of charge on Wednesdays and Saturdays, from 2 to 4 p. m.

The entire institution is managed by a board consisting of the mayor of Nixdorf and 9 associates, most of whom are engaged in the metal industry. The teaching personnel consists of the director, 5 trade instructors, and 3 assistant teachers.

The industrial continuation school received subsidies amounting to 800 florins ($325) from the provincial council, the chamber of commerce of Reichenberg, and the town of Nixdorf. It also received for the aid of indigent pupils from various sources 630 florins ($256), 100 florins ($40.60) of which was given by the ministry of education.

There were 137 pupils at the school at the beginning of the school term 1899–1900, of whom 17 were regular and 2 were special day pupils; 98 attended the continuation courses, and 20 attended the other courses. The 29 persons graduated from the day school in 1895, 1896, and 1897 obtained employment in the metal-working industry at wages ranging from 10 to 20 florins ($4.06 to $8.12) per week.

Schools for Other Trades.

STATE SCHOOL FOR ARTISTIC BRAZING, ENGRAVING, AND BRONZEWORK, GABLONZ.

This institution embraces a day trade school, a drawing course for pupils of the common or grammar schools, a trade continuation school, and an open drawing hall.

The day trade school has divisions for metal engraving and chasing, for gold and silver smithing, for brazing, for drawing and painting, for ceramic work, and for ecclesiastical painting. The last mentioned is an industry peculiar to Gablonz and the surrounding towns. The purpose of the school is to give systematic, theoretical, and workshop instruction in these branches and to impart such a degree of scientific and general knowledge as may be necessary for the advancement of these industries. All courses cover three years, although pupils are advised to continue a fourth year in order to get a more thorough training in their special lines of work.

The theoretical instruction embraces general educational, technical, industrial-art, and commercial branches. The instruction in free-hand and geometrical drawing, perspective, shading, and industrial drawing is intended to enable pupils to execute working drawings in all their details and to prepare sketches and designs and to educate the taste in form and style. Instruction is also given in heraldic design. The commercial instruction includes business forms, arithmetic, and book-keeping.

The greater part of the time of the pupils is spent in the workshop, where they are given all the necessary preparatory training for their respective trades. The engraver is taught all kinds of flat-surface engraving, letter engraving, engraving for enamel work, die cutting, and such other metal work as may be required in the engraver's trade. The chaser is taught all the various operations of chasing on tin and other metals. The braziers and gold and silver smiths learn all the different methods of work in their respective trades from the preparation of the metal to the completion of ornaments and other objects. The latter also receive instruction in surface engraving, enameling, and gold and silver plating. Pupils of the division for ceramic painting are instructed in painting on porcelain, majolica, and glass, color enameling, and glazing. These pupils receive instruction in drawing from models, in decorative painting, and in drawing and painting from nature. This course is also recommended to persons who wish to become lithographers, draftsmen, decorative painters, etc.

The school year begins September 16 and ends July 31. Candidates for admission to the day trade school must be 14 years of age. A tuition fee of 6 florins ($2.44) per year and a matriculation fee of 50 kreutzers ($0.20) are charged. Free tuition and stipends are given to

worthy indigent pupils. Foreigners pay the regular matriculation fee and a tuition of 60 florins ($24.36) per year. Regular pupils who graduate from the day school are entitled to practice their respective trades. Persons who take only single subjects are admitted to the day school as special pupils. In this way, for instance, apprentices who can no take the entire day course may receive a fundamental education in drawing, modeling, and commercial branches. The tuition fee is the same as that for regular pupils.

The drawing course for pupils of the common schools is intended to give them a better knowledge of drawing than they can obtain in the regular public-school course. Instruction is given from 2 to 4 p. m. on Wednesdays and Saturdays, from September 16 to July 15. The pupils must be at least 10 years of age, and the number admitted depends upon the capacity of the school. A tuition fee of 1 florin ($0.41) per term and a matriculation fee of 50 kreutzers ($0.20) are charged. Each pupil must furnish his own requisites.

The trade continuation school and the special courses are intended to give to apprentices and journeymen instruction in drawing and in the industrial and technical work pertaining to individual trades or groups of trades. The school thus comprises 7 trade classes and 5 special courses. The trade classes are as follows: 1 class in technical and trade drawing for carpenters, cabinetmakers, housesmiths, molders, machinists, and similar trades; 4 classes in free-hand and industrial art drawing for braziers and engravers; 1 class in free-hand and trade drawing for persons engaged in painting and decorating porcelain and glass, and for house decorators, lithographers, etc.; 1 class in modeling for engravers, stucco workers, etc. The special courses comprise a class in decorative flower painting, painting on porcelain, and enamel work; a class in figural drawing from plaster casts and from nature, and painting from nature; a class in surface engraving and chasing, which is intended mainly for braziers; a class in metal coloring and galvanizing for braziers; a class in metal pressing and stamping, in which instruction is given by classes of from one to two pupils each. Candidates for admission to this school or to these courses must have passed through at least the second year of the grammar school, or through a general continuation school. The instruction is given on two or three evenings of each week and on Sunday mornings from October 1 to May 31. The special courses are intended particularly for masters and journeymen. The tuition is 1 florin ($0.41) per term and a matriculation fee of 50 kreutzers ($0.20) are required.

The drawing hall is open daily to persons engaged in the various industries, where they have access to the technical library and have opportunities to make sketches and drawings from the collections on hand. They can also obtain technical information and advice with regard to industrial art. No charge is made for these services.

The teaching personnel of the entire institution consists of a director, 12 trade instructors, and 2 assistant instructors.

During the school term 1897-98, 1,391 florins ($565) were given to the pupils in the form of scholarships, stipends, etc., of which amount 550 florins ($223) were received from the ministry of education and the remainder from other sources.

At the beginning of the school term 1899–1900 this institution had an attendance of 291 pupils, of whom 56 were regular and 2 were special day pupils; 196 attended the trade continuation courses, and 37 the other classes.

The best results are obtained from attendance at this school, graduates often entering upon or advancing to good positions. Of the 45 persons graduated from the day school in 1895, 1896, and 1897, 43 obtained employment in industrial art establishments as engravers, chasers, braziers, ceramic designers, and decorators at wages ranging from 7 to 15 florins ($2.84 to $6.09) per week and from 30 to 45 florins ($12.18 to $18.27) per month.

STATE SCHOOL FOR DRAWING AND MODELING, ST. ULRICH IN GRÖDEN.

This school consists of a number of courses intended to meet the needs of different classes of the working population in instruction in drawing, designing, and modeling. There is, first, a day course covering a period of two years, which gives general instruction to boys 13 years of age or over, with special reference to drawing. It is taken by those who expect to enter upon work in which a knowledge of drawing will be useful. The hours of instruction are from 8 to 11 a. m. and from 1 to 4 p. m. Tuition is free. Secondly, there is a so-called course for apprentices, also covering two years, in which the hours of instruction are from 5 to 7 p. m. four work-days each week from October 1 to March 19 and from 6 to 8 p. m. from March 19 to June 1. Instruction is also given for two hours on Sunday morning. This course is intended for boys actually working in shops, and gives them theoretical training in drawing, which they can not well obtain in the shop. A third course is for journeymen, permitting this class to obtain a much-needed instruction in drawing and modeling as applied to their trades. There are also a general finishing course on Sunday morning and a drawing course for boys attending the public schools.

The total attendance on all these courses at the beginning of the school term 1899–1900 was 133 pupils, of whom 20 attended the day courses as regular and 4 as special pupils, 12 attended the continuation course, and 97 attended other classes.

STATE SCHOOL FOR PRECIOUS-STONE GRINDING AND SETTING, TURNAU.

This school comprises a day trade school and an open drawing hall. The day trade school has divisions for precious-stone grinders, goldsmiths, and precious and ornamental stone engravers. Its purpose is to give such theoretical and practical instruction as will enable pupils successfully to practice these trades. The period of instruction in the division for lapidaries is three years and in the divisions for goldsmiths and precious and ornamental stone engravers four years.

The theoretical instruction consists of such general and industrial studies as may be of value in the practice of these trades. Free-hand and geometrical drawing, perspective, and shading, study of forms and styles of ornamentation and trade drawing are taught, with a view to fitting the pupils to prepare artistic designs and sketches for execution in the workshop. Modeling in clay and wax is taught, in order to cultivate the taste for form and to enable pupils to execute such models for metal casting as are used in jewelry work. Instruction in mineralogy, and especially in crystallology, is given, to enable pupils to obtain a thorough knowledge of metals and stones, their names, properties, and uses. Industrial arithmetic, bookkeeping, and business forms are taught, to give pupils such a mercantile knowledge as may be useful to them in carrying on a business of their own.

In the workshops pupils acquire such manual skill and practical knowledge as can not readily be obtained in ordinary shops. In the private workshops grinders of precious stones are usually trained only in the grinding of certain stones or in certain styles or patterns of grinding, there being very few who are capable of performing all the operations of the precious-stone grinding art. In this school pupils learn all the known styles of grinding, as well as machine engraving, on precious and ornamental stones. In the private workshops for goldsmithing, also, the work is usually specialized. At this school, however, the pupils are taught not only the local industry of Bohemian garnet setting, but the setting of all styles of precious stones, besides the manufacture of jewelry and some of the accessory features of the goldsmith's art, such as engraving, chasing, etc. They also learn how to manipulate the various machines and tools used, the alloying of metals, and the methods of refining and finishing gold and silver ware. The division for precious-stone engraving is intended to give a complete technical and artistic training in this work, so as to enable pupils to engrave lettering, monograms, and heraldic coats of arms, and to carve objects in precious and ornamental stone.

The school opens September 16 and closes July 31. Candidates for admission must be 14 years of age and must be graduates of the common schools. Pupils of the grammar schools or institutions of like grade are given a preference. No tuition fees are charged natives, but

foreigners must pay 100 gulden ($40.60) per term. Worthy and indigent pupils receive stipends of from 30 to 80 gulden ($12.18 to $32.48) per year. Special pupils may be admitted at any time of the year, in order to take up single branches of work. When graduated, the regular pupils receive certificates which entitle them to practice their respective trades. Special pupils receive certificates of attendance.

The open drawing hall is intended to offer not only to persons engaged in the goldsmithing and lapidary industries, but to all other local handicraftsmen, an opportunity to obtain instruction in elementary, ornamental, and trade drawing and modeling and to receive such advice with regard to industrial art as they may need in their vocations. This drawing hall has a division for men, one for boys, and one for girls of the public schools.

The entire institution is managed by a board of 8 persons. The teaching personnel consists of a director, 4 trade instructors, 2 foremen, and 2 assistant instructors.

In 1898 the school received 450 gulden ($183) from the ministry of education and 575 gulden ($233) from other sources for use as stipends and otherwise in aid of worthy pupils.

At the beginning of the school term 1899–1900, 58 pupils attended this institution, of whom 25 were regular and 6 were special day pupils, and 27 attended the open drawing hall.

After being graduated, pupils usually find employment as journeymen in Turnau, Prague, and Vienna, or execute work to order in their own shops. The 23 persons graduated in 1895, 1896, and 1897 obtained employment as journeymen in precious-stone cutting and gold-working establishments at wages ranging from 5 to 12 florins ($2.03 to $4.87) and from 10 to 15 florins ($4.06 to $6.09) per week, respectively.

STATE SCHOOL FOR WATCH AND CLOCK MAKING, KARLSTEIN.

This school is organized in two departments, one relating to watch making and repairing and the other to clock making and repairing. The aim of the school is to prepare workmen capable of performing the practical operations of clock and watch making, as well as the repair of these instruments. The pupils thus learn to make all the parts of clocks and watches as well as to put them together. The duration of instruction is three years. To be admitted, pupils must have received an elementary education.

The instruction is both theoretical and practical. The theoretical instruction includes the technology of the trade and designing. Attention is also paid to the commercial aspects of the trade, methods of business, the keeping of accounts, etc. The greatest emphasis, however, is laid on practical work, as five days of the week are devoted to practical instruction, while only one day is given to the theoretical studies.

The teaching personnel is composed of a director, who is also the professor of mechanics and of the history of watch making, and one teacher of mathematics. The number of pupils registered during the school year 1899–1900 was 33.

The director reports that pupils on leaving the school find immediate employment either in the city or in other districts. There is a constant demand for those who have completed the course. Much of the success of the school is stated to be due to the fact that the school keeps in close touch with its former pupils. The school offers especially valuable opportunities to workmen who desire to attend the courses only for a short time or for the purpose of obtaining special instruction.

All of the 28 persons graduated from the day school in 1895, 1896, and 1897 obtained employment in watch and clock making establishments, at wages ranging from 7 to 20 florins ($2.84 to $8.12) per month.

INDUSTRIAL CONTINUATION SCHOOLS.

As stated in the introduction, there were about 650 industrial continuation schools in the Austrian Empire in 1899, besides those courses which are connected with other industrial institutions. These schools have reached their highest degree of development in the city of Vienna. As the Vienna continuation schools are all under the same local administration and have many features in common, they can best be described collectively.

INDUSTRIAL CONTINUATION SCHOOLS, VIENNA.

The industrial continuation schools of the city of Vienna are organized and conducted in accordance with a provincial law passed by the Lower Austrian diet November 28, 1868, and subsequent amendments.

According to the provisions of this law, these schools are organized for the purpose of giving to apprentices and journeymen such a theoretical and, as far as possible, practical knowledge and skill as is necessary to enable them to carry on their vocations. The Lower Austrian provincial school board determines the number of schools to be created. The schools comprise general industrial courses, special trade courses, and preparatory courses. They are conducted either independently or in connection with other institutions. Where these courses are conducted in connection with other schools the teachers of the latter are required to conduct them, and are permitted to use the instruction materials of the schools for this purpose. Extra compensation is granted for such service.

The courses of study are prescribed by the provincial school board, after consultation with the local school board, and must accord as

nearly as possible with the local needs. The preparatory courses must continue the instruction given in the public schools. In the industrial school the instruction must have a technical tendency. Special and trade courses may also be created whenever necessary.

Pupils entering these schools must pass an entrance examination. Attendance may be made compulsory in the case of certain categories of apprentices by action of the provincial school board, with the approval of the provincial council and the Lower Austrian chamber of commerce and industry. Employers of such apprentices are required to look after their attendance and to cooperate with the authorities in the enforcement of the regulations governing such attendance. The compulsory school must not take up more than eight hours per week, and the instruction must be given on week-day evenings and on Sundays. Every employer is required to permit his apprentices and journeymen, of either sex, to attend the schools organized by virtue of this law, provided the hours of instruction are on Sundays or before 9 a. m. or after 6 p. m. on week days. At the close of each course of study the pupils receive graduation certificates.

The Lower Austrian provincial diet, upon the suggestion of the provincial school board, made with the approval of the Lower Austrian chamber of commerce and industry, determines the total amount to be contributed for the support of the industrial continuation schools. For Vienna these contributions are assessed as follows:

Owners of industrial establishments, according to the amount of their income tax, 45 per cent; the municipal government, 20 per cent; the provincial government, 25 per cent; the owners of industrial establishments of Lower Austria who are required to contribute toward the chamber of commerce and industry, according to the amount of their income tax, 10 per cent.

The cost of organizing and maintaining special trade courses devolves upon the participating owners of establishments in each school district. Whenever the provincial school board perceives that such a trade school accomplishes its purpose and that the participating employers carry out the provisions of the law regarding compulsory attendance, the amount expended may be reimbursed out of the funds for the support of the regular industrial continuation schools. Whenever continuation courses are connected with other schools the latter bear the expenses for fuel and light.

All the industrial continuation schools of Lower Austria are under the jurisdiction of the provincial school board. In the consideration of matters relating to these schools this board must include two representatives of the chamber of commerce and industry and two representatives of the industrial school inspectors of the province. This board regulates the organization of continuation schools, prepares

the programmes of instruction, determines the quota of the appropriation to be expended for each school, and the salaries of teachers, etc., and has general supervision over the schools. Each special-trade continuation school is under the immediate supervision of a committee of six members elected for three years by the participating owners of establishments, and they in turn are under the jurisdiction of the local school board, or in the case of Vienna, under the industrial school commission. The preparatory and general industrial continuation schools are under the immediate control of the local school board. In matters pertaining to these schools, the industrial school inspectors and principals of continuation schools are represented in these local boards. The provincial school board may create special industrial school commissions whose jurisdiction replaces that of the local school boards with regard to this class of schools. This body appoints the principals, teachers, and other employees, supervises the instruction, and conducts the administrative and economic affairs of the schools. Such a commission exists in Vienna. The industrial school inspectors are elected for three years by the owners of establishments who contribute toward the support of the continuation schools. They, as well as the members of the school boards, serve without pay. They are required to visit the schools, as assigned by the local school board, and report to the latter.

Schools maintained purely by private means do not come within the provisions of this law.

The industrial school commission (*Gewerbeschul-Commission*), which has immediate supervision over the industrial continuation schools of Vienna, publishes annual reports of the operations of these continuation schools or classes. According to the report for the school term 1898–99, the industrial continuation schools of Vienna were divided into the following four classes: (1) Industrial preparatory courses; (2) industrial continuation schools for apprentices and journeymen; (3) industrial continuation schools for girls; (4) trade continuation schools for apprentices and journeymen, and trade schools for the female apprentices of the association of linen-goods manufacturers.

The preparatory courses include classes of a general nature and special courses for hotel and café employees.

The industrial preparatory courses were first instituted in 1873 and are compulsory for apprentices who have not completed their common school education and are over 14 years of age. These schools are intended to give such an education in reading, writing, arithmetic, and drawing as will prepare apprentices for the studies taught in the industrial continuation schools. Instruction is given on Sundays from 8.30 to 11.30 a. m., and on Mondays from 6.30 to 8.30 p. m. No tui-

tion fee is charged. The following subjects, and hours per week for each, are prescribed for the preparatory courses:

First year: Reading, grammar, and composition, 3; arithmetic, 2; penmanship, 2.
Second year: Reading, grammar, and composition, 2; arithmetic, 2; penmanship, 1; free-hand drawing, 2.

During the school term 1898–99 there were 69 of these preparatory continuation schools, with 135 classes and 258 principals and teachers. Of 12,901 pupils enrolled 9,479, or 73.5 per cent, remained until the end of the term, and 10,026, or 77.7 per cent, completed their course of study. The average attendance was 8,407, or 65.2 per cent of the pupils enrolled. The attendance at these schools is greatest during the winter months.

The preparatory courses for hotel and café employees are intended to give to apprentices in that industry the necessary preliminary education which will fit them for admission to the trade continuation schools of the hotel keepers' and café owners' guilds (*Genossenschaften der Gastwirte und Kaffesieder*) of Vienna. The programme of instruction is the same as for the general industrial preparatory courses. Instruction is given three times per week from 4.30 to 6.30 p. m.

During the school term 1898–99 there were 8 of these schools in Vienna, with 11 principals and teachers and 649 pupils. Of the latter, 522, or 80.4 per cent, remained until the close of the term, and 466, or 71.8 per cent, completed their course of study.

The industrial continuation schools for apprentices and journeymen are intended to give to apprentices and journeymen such a theoretical and, as far as possible, a practical knowledge and skill as will better fit them for the practice of their trades. Only such persons are admitted as have passed the compulsory school age and can present certificates of graduation from the common or grammar schools (*Volks- oder Bürgerschulen*) or can pass the prescribed examinations. No tuition fee is charged. Instruction is given on Sundays, usually from 8.30 to 11.30 a. m., and on from three to five week days from 6.30 to 8.30 p. m.

The following courses of study and hours per week devoted to each are prescribed for all the industrial continuation schools for apprentices and journeymen of Vienna:

First year: German language and business forms, 1½; geography, 1½; arithmetic and geometry, 1; geometrical drawing, 4; free-hand drawing, 4.

Second year: Drawing for the building trades, 3 to 4; mechanical drawing, 3 to 4; industrial-art drawing, 3 to 4; modeling, 2 to 4; physics, 1 to2; industrial chemistry, 1 to 2; projections, 1; elements of architecture, 1; elements of mechanics and machinery, 1 to 2; bookkeeping and industrial law, not specified; mechanical technology, 1 to 2; stonecutting (winter term), 4.

During the school term 1898–99, there were 35 of these industrial continuation schools in Vienna, with 72 separate classes and 381 principals and teachers. Of 8,445 pupils enrolled, 6,672, or 79 per cent, remained until the close of the term, and 5,668, or 67.1 per cent, completed their course of study. The average attendance was 6,046, or 71.6 per cent of the pupils enrolled.

The industrial continuation schools for girls have for their object the education of working girls or women and those who wish to prepare for an industrial or commercial vocation in such branches of study as will be of value to them in their work. Only such females are admitted as can present certificates of graduation from the common or grammar schools. Instruction is given on Sunday mornings and on week-day afternoons.

The course of instruction is not the same in all the schools. Some schools have two and others have three year courses. The following programme of studies and hours per week devoted to each, for one of the schools, will give an idea of the nature of the instruction:

First year: German language, 1; style and business forms, 1; correspondence, 1; arithmetic, 2; bookkeeping, 1; geography, 1; physics, 1; penmanship, 1; drawing, 3; French language, 2; female handiwork, 10.

Second year: German language, 1; commercial correspondence, 1; arithmetic, 2; bookkeeping, 1; geography, 1; chemistry, 1; stenography, 2; drawing, 3; French language, 2; exchange, 1; female handiwork, 10.

Instruction in handiwork consists of sewing, art embroidery, dressmaking, taking measurements, and drawing patterns for garments.

During the school term 1898–99, there were 8 industrial continuation schools for girls, with 22 separate classes, and 98 principals and teachers. Of 1,593 pupils enrolled 1,375, or 86.4 per cent, completed their course of study. The average attendance was 1,298, or 81.5 per cent of the number enrolled.

The special trade continuation schools and courses are each organized for a particular trade. Most of them were created by trade guilds. During the school term 1898–99, there were 33 of these schools in Vienna which had been placed under the jurisdiction of the school authorities in accordance with the law of November 28, 1868. Of these 33 schools, 31 were for males, and 2 for females. The 33 special trade continuation schools contained 107 separate classes, with a total teaching personnel numbering 300. During the school term 1898–99, 9,519 pupils matriculated, of whom 8,024, or 84.3 per cent, remained until the close of the term, and 6,765, or 71.1 per cent, completed their course of study. The average attendance was 7,658, or 80.4 per cent of the pupils enrolled. The following table shows the number of schools, teachers, and pupils for each trade represented in these institutions:

SPECIAL TRADE CONTINUATION SCHOOLS, VIENNA, TERM 1898–99.

Trades for which organized.	Schools or courses.	Principals and teachers.	Pupils.	
			Matriculated.	Completed course.
Bakers	4	19	805	574
Basket makers	1	2	29	18
Bookbinders and makers of leather and pasteboard goods	1	3	64	51
Braziers, bronze workers, and chasers	1	4	122	106
Butchers	1	15	467	334
Cabinetmakers	1	7	184	133
Confectioners	1	6	158	138
Decorators, interior	1	5	156	100
Glaziers	1	4	44	41
Hotel and restaurant employees	2	41	1,022	647
Jewelers and gold and silver smiths	1	10	240	180
Lithographers and lithographic and copperplate printers	1	6	91	58
Lock and house smiths	1	4	180	162
Mercantile employees	3	71	3,308	2,272
Opticians	1	3	33	25
Painters, house and wagon	1	6	149	96
Paper hangers	1	6	170	112
Piano and organ makers	1	4	57	37
Printers and type founders	1	20	529	501
Seamstresses	2	15	326	221
Tailors	1	8	355	265
Tinsmiths	1	5	260	186
Watchmakers	1	4	195	105
Weavers, knitters, and trimming makers	1	16	299	220
Wood turners	2	16	276	183
Total	33	300	9,519	6,765

In these trade continuation schools there is no uniformity of programmes, the course of study at each school being specialized to fit the particular trade for which the school was organized. Following are the subjects taught, and hours per week devoted to each, for each of the trade continuation schools, except those for mercantile employees:

TRADE CONTINUATION SCHOOL FOR BAKERS.

Preparatory course: Arithmetic, 2; German language and reading, 2; exercises in orthography, 1; style, 1.

Trade course: Arithmetic and bookkeeping, 1½; business forms, 1½; physics and chemistry, 3.

TRADE CONTINUATION SCHOOL OF THE BASKET MAKERS' GUILD.

First year: Geometry and geometrical drawing, 2; free-hand drawing, 1½; trade drawing, 1½.

Second year: Geometry (stereometry) and projections, 1; geometrical and projection drawing, 1; free-hand drawing, 1½; trade drawing, 1½.

Third year: Projections and shading, 1; projection drawing, 1; shaded designs, 1; free-hand drawing; trade drawing, 3.

TRADE CONTINUATION SCHOOL OF THE BOOKBINDERS AND LEATHER AND PASTEBOARD GOODS AND CASE-MAKERS' GUILD.

Free-hand, trade, and geometrical drawing, 6; practical instruction in hand and press gilding, 4; bookkeeping, time not specified.

TRADE CONTINUATION SCHOOL FOR BRAZIERS, BRONZE WORKERS, AND CHASERS.

First year: Study of projections, with exercises in drawing, 2; free-hand drawing, 4 modeling, 4.

Second year: Free-hand drawing (for chasers), 2; free-hand drawing (for mounters and other bronze workers), 4; modeling, 2; chemistry and physics, 2; chasing (for chasers), 4; chasing (for mounters and other bronze workers), 2.

Third year: Trade drawing, 2; modeling, 2; chasing, 4; bookkeeping, 2.

TRADE CONTINUATION SCHOOL OF THE BUTCHERS' GUILD.

Preparatory course: Reading and grammatical exercises, 2; arithmetic, 2; penmanship, 1.

First year: German language, 2½; arithmetic, 1½; trade instruction, 1.

Second year: German language, 1½; industrial arithmetic, bookkeeping, 2½; trade instruction, 1.

TRADE CONTINUATION SCHOOL FOR APPRENTICES OF THE VIENNA CABINETMAKERS' GUILD.

Technical drawing: Elements of geometry, study of geometry, elements of shading.

Trade division for cabinetmakers: Free-hand drawing, furniture drawing from objects, free-hand drawing from plaster models.

Trade division for joiners: Drawing of simple joinery objects, drawing from plaster models.

Industrial arithmetic: Business forms, industrial bookkeeping.

The hours per week devoted to each study are not specified.

TRADE CONTINUATION SCHOOL OF THE CONFECTIONERS' GUILD.

First year: Free-hand drawing, 2; German, 1; arithmetic, 1; chemistry, 1; penmanship, 1.

Second year: Free-hand drawing, 1; modeling, 1; German, 1; arithmetic and industrial bookkeeping, 1; chemistry and study of materials, 1.

TRADE CONTINUATION SCHOOL FOR DECORATORS AND DECORATIVE PAINTERS.

First year: Language, 2; arithmetic, 2; geometry, 1; free-hand drawing, 2; geometrical drawing, 2.

Second year. Chemistry, 1; arithmetic, 1; bookkeeping, 1; trade instruction (drawing and modeling), 6.

TRADE CONTINUATION SCHOOL OF THE GLAZIERS, GLASS DEALERS, AND GLASS GRINDERS' GUILD.

Language, including grammar, composition, and business forms, 1; arithmetic, 1; free-hand drawing, 2; penmanship, 1; trade instruction, 2.

TRADE CONTINUATION SCHOOLS OF THE RESTAURANT AND CAFÉ KEEPERS' GUILD.

For restaurant-keepers' apprentices.

First year: German language, 2; arithmetic, 1; calligraphy, 1; French language, 2.

Second year: Business forms, 1; bookkeeping and arithmetic, 1; trade instruction, 2; French language, 2.

For café-keepers' apprentices.

First year: German language, 2; arithmetic, 1; French language, 2; trade instruction, 1.

Second year: Business forms, 1; arithmetic, 1; French language, 2; trade instruction and study of food and food products, 1; geography and bookkeeping, 1.

Special courses.

For cooks' apprentices: Drawing and modeling, 2.

For graduates of the first-year courses: French language, 2.

For graduates of the second-year courses: French language, 2 to 4; English language, 2 to 4.

TRADE CONTINUATION SCHOOL OF THE HOTEL-KEEPERS' GUILD.

First year: German language (business forms), 1; industrial arithmetic, 1; penmanship, 1; French language, 2; instruction in the manner of serving and in the nature of food and food products, 1.

Second year: German language (business forms), 1; industrial bookkeeping and arithmetic, 1; geography and history of native country, 1; instruction in the manner of serving and in the nature of food and food products, 1.

Special courses.

For cooks' apprentices: Drawing and modeling, 2.

For graduates of the second-year course: French language, 2 to 4; English language, 2 to 4.

TRADE CONTINUATION COURSE FOR JEWELERS, GOLD AND SILVER SMITHS, AND ENGRAVERS.

First year: Projection drawing, 2; free-hand drawing, 4; modeling, 2 to 4; physics (summer term), 1; chemistry, 3; calligraphy (summer term), 1; engraving, 4; chasing, 4.

Second year: Modeling, 2 to 4; chemistry, 3; engraving, 4; chasing, 4; bookkeeping, 2.

TRADE CONTINUATION SCHOOL FOR LITHOGRAPHERS AND LITHOGRAPHIC AND COPPERPLATE PRINTERS.

First year: Elementary free-hand drawing, geometry and geometrical drawing, study of materials, industrial arithmetic, calligraphy, German language.

Second year: Free-hand drawing and industrial art, trade drawing, study of projections, calculating and making price estimates, study of materials with special reference to the art of printing.

The hours per week devoted to each study are not specified.

TRADE SCHOOL FOR APPRENTICES OF THE VIENNA LOCK AND HOUSE SMITHS' GUILD.

First year: Geometrical drawing, 2; projections; free-hand drawing, 3; industrial arithmetic and bookkeeping, 1.

Second year: Industrial arithmetic and bookkeeping, 1; trade drawing, 2; technology, 1.

TRADE COURSE OF THE OPTICIANS' GUILD.

This course is intended only for apprentices who have completed a course of study at an industrial continuation school and are approaching the close of their term of apprenticeship. The instruction is therefore entirely technical and includes the study of optics, the nature and use of lenses and optical instruments, the structure of the eye, etc.

TRADE SCHOOL FOR HOUSE AND WAGON PAINTERS' APPRENTICES.

First year: Language, 2; arithmetic, 2; drawing, 2.

Second year: Language, 1; arithmetic, 1; geometry and geometrical drawing, 2; free-hand drawing, 2.

TRADE CONTINUATION SCHOOL OF THE PAPER HANGERS' GUILD.

First year: German language and business forms, 1; arithmetic, 1; geometrical designs in connection with geometrical drawing, 2; free-hand drawing, 2.

Second year: Arithmetic and simple industrial bookkeeping, 1; geometry and study of projections, 1; free-hand drawing, 3; practical instruction, 1.

Third year: Free-hand drawing and study of styles, 4; practical instruction, 1.

TRADE CONTINUATION SCHOOL FOR ORGAN AND PIANO MAKERS.

First year: German language and business forms, 1½; geography, ½; physics, 1; geometry and geometrical drawing, 1½; free-hand drawing, 1½.

Second year: Industrial laws and business forms, 1; arithmetic and industrial bookkeeping, 1; projections, 1; acoustics, 1; constructive drawing, 3.

TRADE CONTINUATION SCHOOL FOR PRINTERS' AND TYPE FOUNDERS' APPRENTICES.

First year: German language, 2; drawing, 2; industrial arithmetic, 1; instruction in composition, 1; reading from manuscripts and proof reading, 1.

Second year: German language, 1; French language, 1; drawing, 2; instruction in composition, 1; instruction in printing and study of materials, 1; reading from manuscripts and proof reading, 1.

Third year: German language and history of the art of printing, 1; French language, 1; instruction in composition, 2; instruction in printing and study of materials, 2; reading from manuscripts and proof reading, 1.

Class in type founding: Instruction in type founding and study of materials, 1½; physics and mechanics, 1½.

TRADE CONTINUATION SCHOOL FOR FEMALE APPRENTICES OF THE LINEN GOODS MANUFACTURERS' GUILD.

First year: German language, 1; arithmetic, 1; penmanship, 1; drawing, 2; female handiwork, 4.

Second year: German language, 1; arithmetic and industrial bookkeeping, 1; study of materials, 1; drawing, 2; female handiwork and work on sewing machines, 4.

TRADE CONTINUATION SCHOOL FOR APPRENTICES OF THE GARMENT MAKERS' GUILD.

Preparatory course: German language, 3; arithmetic, 2; free-hand drawing, 2.

First year: German language and business forms, 2; arithmetic, 2; free-hand drawing, 2; trade instruction, 1.

Second year: German language and business forms, 1; arithmetic and industrial bookkeeping, 1; free-hand drawing, 2; geometry, 1; anatomy, 1; trade instruction, 2.

Third year: German language and business forms, 1; arithmetic and industrial bookkeeping, 1; free-hand drawing, 2; geometry, 1; anatomy, 1; trade instruction, 2; special trade instruction for ladies' tailors, 2.

TRADE SCHOOL FOR APPRENTICES OF THE TINSMITHS' GUILD.

First year: Arithmetic, 1; geometrical designs in connection with geometrical drawing (every other week), 2; free-hand drawing (every other week), 2.

Second year: Free-hand, geometrical, and trade drawing. The time devoted to each study is not specified.

TRADE CONTINUATION SCHOOL FOR WATCHMAKERS.

First year: Arithmetic, 1½; geometery, geometrical and projection drawing, 2; physics, ½; applied theory (trade instruction), 1; trade drawing, 1.

Second year: Arithmetic, ½; physics, 1; applied theory (trade instruction), 1½; trade drawing, 3.

Third year: Trigonometry, ½; chemistry, ½; electricity and magnetism, 1; applied theory (trade instruction), 2; trade drawing, 2.

TRADE CONTINUATION SCHOOL FOR WEAVERS, KNITTERS, AND TRIMMING MAKERS.

Course for weavers.

First year: Technology of hand weaving, study of materials, study of weaving, analysis, and calculation, 3; free-hand drawing and practical weaving, 3.

Second year: Technology of hand weaving, study of weaving, analysis, and calculation, 3; trade drawing, making of designs, and practical work, 3; German business forms, commercial arithmetic, and bookkeeping, 2.

In the first year plain weaving and in the second year Jacquard weaving is taken up.

Course for knitters.

First year: Technology of knitting, study of materials, analysis, calculation, 3; practical work on simple knitting machines, 6; German business forms, commercial arithmetic, and bookkeeping, 2.

Course for ribbon and trimming makers.

First year: Trade technology, study of materials, study of weaving, analysis, and calculation, 3; free-hand drawing, and practical work, 3.

Second year: Trade technology, study of materials, study of weaving, analysis, and calculation, 3; free-hand drawing and practical work, 3; German business forms, commercial arithmetic, and bookkeeping, 2.

TRADE CONTINUATION SCHOOLS OF THE VIENNA TURNERS' GUILD.

First year: Elementary free-hand drawing, 2; geometrical drawing and elements of geometry, 3; industrial arithmetic, business forms, and industrial bookkeeping, 3; physics and chemistry, 2.

Second year: Study of styles, trade drawing, and modeling, 6; technology of the wood-turning industry—(1) theoretical instruction with demonstrations, 2; (2) practical instruction alternating with trade drawing—(*a*) wood turning and other raw materials, 6; (*b*) carving on wood, meerschaum, agalmatolite, and engraving on mother-of-pearl, bone, amber, etc., 6; calculation, 1; chemical instruction in bleaching, coloring, etc., 1.

Third year: Study of styles, trade drawing, and modeling, 6; practical instruction alternating with trade drawing—(1) turning in wood and other raw materials, 6; (2) carving in wood, meerschaum, etc., and engraving on mother-of-pearl, bone, etc., 6; (3) methods of finishing by chemical treatment (bleaching, coloring, macerating, etc.), 3.

These special trade courses usually cover from one to three years each. The length of the school term is usually ten months per year, although in a few cases it is considerably less. The hours of study vary greatly in the different schools, ranging from 1½ to 20 per week.

At the beginning of the school term 1898–99 there were 153 industrial continuation schools, with 344 classes and 1,048 principals and teachers, under the supervision of the industrial school commission of Vienna. A total of 33,107 pupils matriculated, of whom 24,238 completed their course. The following table shows the total number of schools, classes, teachers, and pupils for each of the four classes of continuation schools:

INDUSTRIAL CONTINUATION SCHOOLS, VIENNA, TERM 1898–99.

Character of school or course.	Schools or courses.	Classes.	Principals and teachers.	Pupils.	
				Matriculated.	Completed course.
General preparatory courses and preparatory courses for hotel and café employees	77	143	269	13,550	10,492
Industrial continuation schools for male apprentices	35	72	381	8,445	5,668
Industrial continuation schools for girls	8	22	98	1,593	1,313
Special trade continuation schools for male and female apprentices	33	107	300	9,519	6,765
Total	153	344	1,048	33,107	24,238

The number of apprentices and journeymen who matriculated in each of these classes of schools, except the industrial continuation schools for girls, is shown for each occupation in the two following tables:

APPRENTICES AND JOURNEYMEN MATRICULATING IN THE INDUSTRIAL CONTINUATION SCHOOLS OF VIENNA, BY OCCUPATIONS.

APPRENTICES.

Occupations.	Industrial continuation schools.				Occupations.	Industrial continuation schools.			
	Trade.	General.	Preparatory.	Total.		Trade.	General.	Preparatory.	Total.
Bakers	805	3	45	853	Dentists	.....	14	3	17
Basket makers	26	3	28	57	Draftsmen	36	15	1	52
Blacksmiths	.....	140	236	376	Dyers	.....	65	78	143
Bandage makers	.....	11	3	14	Earthenware makers	.....	14	12	26
Bedding makers	.....	2	8	10	Engravers, glass and metal	105	69	7	181
Bookbinders	28	221	113	362	Fan makers	.....	7	13	20
Brass workers	.....	14	10	24	File cutters	.....	19	36	55
Bronze workers	45	201	81	327	Finishers, textile	.....	9	4	13
Brush makers	.....	21	46	67	Founders	.....	267	183	450
Butchers	467	40	88	595	Furriers	.....	41	129	170
Cabinetmakers and joiners	182	520	2,278	2,980	Galvanizers	.....	3	1	4
Café employees	129	.....	13	142	Gardeners	.....	24	15	39
Carpenters	.....	45	95	140	Gas and water pipe layers	.....	63	25	88
Case and sheath makers	5	43	76	124	Gem cutter	.....	.....	1	1
Chasers	79	88	6	173	Gilders	1	61	19	81
Clock and watch makers	180	13	32	225	Glass blowers	.....	9	2	11
Chimney sweeps	.....	6	13	19	Glass cutters	.....	2	7	9
Commercial occupations	3,294	3	4	3,301	Glaziers	44	26	36	106
Confectioners	158	4	13	175	Glove makers	.....	22	20	42
Coopers	.....	43	138	181	Gold and silver smiths and jewelers	116	326	95	537
Copperplate printers	4	4	.....	8	Gunsmiths	.....	19	8	27
Coppersmiths	.....	42	39	81	Hairdressers and barbers	.....	17	17	34
Cutlers, tool smiths, and ornamental wrought-iron workers	.....	37	48	85	Hat makers	.....	53	82	135
Decorators	156	30	56	242	Hotel and restaurant employees	893	6	638	1,537
					Horseshoers	.....	.....	2	2

APPRENTICES AND JOURNEYMEN MATRICULATING IN THE INDUSTRIAL CONTINUATION SCHOOLS OF VIENNA, BY OCCUPATIONS—Concluded.

APPRENTICES—Concluded.

Occupations.	Industrial continuation schools.				Occupations.	Industrial continuation schools.			
	Trade.	General.	Preparatory.	Total.		Trade.	General.	Preparatory.	Total.
Instrument makers	54	61	25	140	Rope makers	.....	5	15	20
Knitters	19	.....	.....	19	Rulers	.....	1	1	2
Lacquerers	42	30	42	114	Saddle, harness, and valise makers	.....	173	280	453
Leather goods workers	25	137	111	273	Sculptors	.....	340	82	422
Lithographers	84	122	15	221	Seamstresses	326	19	14	359
Locksmiths	143	1,425	1,322	2,890	Shearers, woolen cloth	.....	1	1	2
Machinists	38	922	107	1,067	Shoemakers	.....	355	2,388	2,743
Masons	.....	330	608	938	Sieve and lattice makers	.....	7	9	16
Metal workers	.....	668	223	891	Soap boilers	.....	.....	6	6
Molders	1	1	.....	2	Spur makers	.....	8	5	13
Molding cutters	.....	2	2	4	Stonecutters	.....	57	35	92
Needle makers	.....	3	3	6	Stuccoworkers and plasterers	.....	9	20	29
Opticians	30	21	3	54	Sword makers	.....	6	2	8
Painters	107	11	17	135	Tailors	355	257	2,063	2,675
Painters, glass, porcelain, etc	6	49	2	57	Tanners	.....	4	29	33
Painters, sign and letter	.....	59	6	65	Tinsmiths	260	107	228	595
Parasol and umbrella makers	.....	4	16	20	Toy makers	.....	2	3	5
Pasteboard goods workers	.....	7	7	14	Trimming makers	100	12	10	122
Pattern and embroidery designers	8	2	.....	10	Turners, wood, ivory, etc	214	144	516	874
Pavers	.....	4	10	14	Type founders	12	5	.....	17
Photographers	.....	8	1	9	Upholsterers	168	111	167	446
Pipe cutters	.....	4	.....	4	Wagon makers	3	10	8	21
Platers	.....	16	12	28	Weavers	25	1	34	60
Printers and typesetters	517	127	22	666	Wheelwrights	.....	53	165	218
Ribbon makers	3	1	.....	4	Wire drawer	.....	1	.....	1
Roofers	.....	7	10	17	Not reported	.....	7	.....	7
					Total	9,293	8,401	13,548	31,242

JOURNEYMEN.

Basket makers	3	.....	.....	3	Knitters	10	.....	.....	10
Blacksmith	.....	1	.....	1	Lithographers	3	1	.....	4
Bookbinders	4	2	.....	6	Locksmiths	29	12	1	42
Bronze worker	.....	1	.....	1	Machinists	1	1	.....	2
Cabinetmakers	2	7	1	10	Mason	.....	1	.....	1
Case and sheath maker	1	.....	.....	1	Metal workers	.....	2	.....	2
Chasers	1	1	.....	2	Opticians	3	.....	.....	3
Clock and watch makers	5	.....	.....	5	Photographer	.....	1	.....	1
Commercial occupations	44	.....	.....	44	Ribbon makers	3	.....	.....	3
Decorator	.....	1	.....	1	Sculptors	.....	6	.....	6
Draftsmen	12	1	.....	13	Spur maker	1	.....	.....	1
Engravers	8	.....	.....	8	Stuccoworker and plasterer	.....	1	.....	1
Founder	.....	1	.....	1	Tinsmith	.....	1	.....	1
Gas and water pipe layer	.....	1	.....	1	Trimming makers	5	.....	.....	5
Gold and silver smiths	7	1	.....	8	Turners, wood, ivory, etc	33	.....	.....	33
Instrument makers, musical	3	.....	.....	3	Upholsterers	2	1	.....	3
					Wagon makers	4	.....	.....	4
					Weavers	42	.....	.....	42
					Total	226	44	2	272

The entire cost of the industrial continuation schools and courses, as far as it was met by the industrial school commission, in accordance with the provisions of the law of 1868, amounted to 324,023 florins

($131,553) during the year 1898. This amount was distributed as follows:

General expenses	$6,074
Preparatory continuation schools	36,902
Industrial continuation schools	66,934
Trade continuation schools	19,547
Cost of an industrial exposition	924
Prizes awarded to pupils	1,172
Total	131,553

This does not include the expenditures privately incurred by the guilds for the special trade continuation schools in which they are interested, the amount of which is not known. There were also special State subsidies amounting to 36,050 florins ($14,636), subsidies of 4,580 florins ($1,859) by the provincial board of commerce and industry, and of 8,800 florins ($3,573) by the city of Vienna for special trade continuation schools and courses. In addition to this the city of Vienna bore the cost of lighting the school rooms, which involved an average annual expenditure of about 10,000 florins ($4,060).

ATTITUDE OF EDUCATORS, EMPLOYERS, AND GRADUATES OF TRADE AND TECHNICAL SCHOOLS TOWARD TRADE AND TECHNICAL EDUCATION.

With regard to the opinions of educators, employers, and trade-school graduates toward trade and technical education in Austria the following information has been received by means of personal interviews:

A prominent official of the imperial Austrian ministry of education stated that trade schools have been especially effective in reviving the old cottage industries of lace working and basket making, and have improved the educational and industrial condition of the working classes. Trade unions have played practically no part either in creating or in opposing the creation of these schools. Trade education generally, in his opinion, has enabled pupils to improve their condition and to fit themselves for a higher class of work, either immediately or ultimately. With regard to the preference for trade-school graduates by employers or superintendents, this official says that experience varies considerably. Trade-school pupils, on entering the shops, do not have the same manual dexterity as those who have been several years at practical work. Some employers therefore prefer the latter as being more dexterous. Others, however, realize that ultimately the school-trained boys will become the more valuable workmen and therefore prefer to employ them. The trade schools have generally, in his opinion, proved satisfactory and have fully attained the end for which they were established. He believes that the best results in pure trade education are obtained through boys entering the shop and attending at the same

time the evening and Sunday classes, which give them the theory and general instruction concerning the industries in which they are employed.

The director of an establishment for the manufacture of electrical machinery and supplies in Vienna, employing 32 foremen and about 2,000 wage-workers, stated that all his foremen and about 20 per cent of his wage-workers had attended trade schools, especially the schools for foremen, the State industrial schools, and the Technological Industrial Museum. His establishment encourages in every way the attendance of evening continuation schools by its employees. The director states that persons educated in trade and continuation schools can more readily obtain employment, receive better positions and wages, and advance more rapidly than persons not so educated. The attendance at trade schools by employees of this establishment has been of great value to the latter, especially in the case of machine and electrical fitters and mounters. The best training for a thoroughly skilled workman, in the opinion of this director, is a three or four years' apprenticeship in a well-regulated establishment, with a simultaneous attendance at an industrial continuation school; after the completion of the apprenticeship, several years' practical work as journeyman in different establishments, followed by an attendance at the evening courses of an industrial school. Those persons, however, who aspire to become foremen of workshops, foremen of fitters or mounters, etc., ought to take a full course at a school for foremen, a day State industrial school, or the Technological Industrial Museum.

Statements were received from an assistant foreman of machinists and from a number of machinists and other skilled metal workers in Vienna, some of whom attended the State industrial schools and others the Technological Industrial Museum at different times from 1894 to 1900. The assistant foreman attended both of these classes of institutions. Nearly all of the men received employment immediately upon leaving school. They all agree in saying that the education received in a trade school facilitated their obtaining employment and insured the retention of their positions, and increased their chances for obtaining higher posts and better wages. They believe, however, that a trade-school education alone is insufficient, and that in order to be effective it must be preceded by several years' practical experience, otherwise the student will not have a proper understanding of the subjects taught.

Information regarding the trade continuation schools of the hotel, restaurant, and café owners' guilds in Vienna was received from the principals of these schools and from one hotel proprietor.

The principals of these schools stated that attendance is compulsory for all apprentices of members of the guild, and that the apprentices are usually graduated between the ages of 16 and 18 years. They are employed while attending the school, and if they choose to leave their

employers after their apprenticeship term, and have been orderly and diligent, they can find immediate employment. Since the establishment of the schools from 25 to 40 per cent more apprentices find employment in foreign countries. Persons who have not attended these schools have great difficulty in finding employment as waiters, hotel clerks, etc., in Vienna. Those who have been graduated with good records advance very rapidly, especially in foreign countries. These continuation schools have, in the opinion of the principals, proved very satisfactory, but regular day schools would be desirable for prospective owners or managers of hotels.

A hotel manager employing from 40 to 50 persons reported that about 20 of these employees attended the trade continuation schools of the hotel, restaurant, and café owners' guilds. Attendance at the schools is compulsory for certain classes of hotel employees while serving an apprenticeship. He considers it a duty to encourage the schools in every way, because persons graduated by them find employment more readily, secure better positions and higher wages, and advance more rapidly than others. One great advantage is that persons who served apprenticeships in other than first-class hotels are no longer barred from advancement as was formerly the case. The quality of the service rendered by graduates of these schools is greatly superior to what it was formerly. Before the establishment of these schools the higher posts, such as managers, hotel clerks, etc., were filled by foreigners, mostly Germans and Swiss, but now these positions are being filled by graduates of these schools.

With regard to the trade continuation schools for female apprentices of the linen goods manufacturers' guild, a statement was made by the president of the guild, who was also chairman of the administrative board of these schools. In his opinion, schools of his guild have the advantage that they teach all the different operations performed in the various branches of linen goods manufacture, and that the graduates can therefore more readily adapt themselves to changes in styles or fashions. As apprentices in establishments, the girls acquire training only in single branches, and are as a rule engaged on the same class of work from 8 a. m. until 7 p. m.; but during the two hours per day on three week days, when they are compelled to attend the guild schools, they obtain instruction in all branches. It is surprising, he said, what is being accomplished by the trade continuation schools, as demonstrated by the exhibitions at the close of each school year. They unite theory and practice in beautiful harmony. He admits that some of the members of the guild do not like to see their apprentices spend that part of the time in school which would otherwise be spent in the factory, but he said that this probably justifiable ambition of the individual should not deter the guild in its effort to afford the younger people an opportunity to become educated in the various branches of

work for their own benefit and usefulness, and later on also for the good of the guild, for, with competent labor, the manufacturer can advance more easily and can thus benefit himself and his industry.

Two manufacturers of linen goods in Vienna who replied to the inquiries differ on almost every point with regard to the results of these schools. One of them encourages in every way he can the attendance of these schools. He believes that women educated therein can more readily find employment, are more apt to advance to higher positions, and can secure higher wages. The other employer can see no merit whatever in these schools, and considers the requirement which compels him to allow his female apprentices certain hours during the day for school attendance a positive detriment both to himself and to the apprentices on account of the time lost. It may be said, however, that this employer has a collar and cuff factory, where all the work is specialized and is mostly done by machinery—consequently there is not much occasion in his establishment for school-trained employees.

Two foremen of establishments for the manufacture of linen goods, one of whom is a member of the board of control of the continuation school of the linen manufacturers' guild, agree that the trade continuation schools for girls are advantageous in enabling the girls to obtain employment and in facilitating their advancement to higher pay and better positions. Such schools have a tendency to stimulate exactness and artistic taste and to awaken an interest in the work.

CHAPTER IV.

TRADE AND TECHNICAL EDUCATION IN BELGIUM.

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INTRODUCTION.

In the general extension of the systems of industrial education in Europe, Belgium has not been behindhand. She has undoubtedly been influenced more or less by the movement in neighboring countries, and, within a few years, has laid the foundation of a fine system of schools for the technical training of her youth. This system presents some characteristic and peculiar features.

There is no general law regulating trade and technical education in Belgium. The State has created no schools of its own. Complete liberty in the matter of originating movements for the formation of trade and technical schools has been left to the local authorities or to private individuals. The Government has taken the position that, as such schools should be organized with a view to meeting strictly local needs, there should be considered from a local point of view such questions as are presented by the character of the industries to be benefited, the degree of intelligence of prospective pupils, and numerous other elements peculiar to each locality. Under such circumstances there has been no attempt to follow a uniform model. The preceding remarks relate only to the formation of schools. In succeeding paragraphs it will be seen that the Government eventually exercises a supervision over these schools after it has once come to their financial aid. Such supervision as the State exercises is vested in the ministry of industry and labor.

While there is no general law governing the formation of trade and technical schools, the Government has developed a system for subsidizing such schools. Each year the Parliament places at the disposal of the ministry of industry and labor a sum to be distributed among the schools under consideration. Such schools, whether provincial, communal, or private, as desire to receive a portion of this appropriation must submit a formal application, accompanied by certain documents which will allow the ministry to judge if the school comes within the classification for which the subsidy is intended. These documents are the school's organic law, the detailed outline of studies or exercises, the programme of class hours, the account of receipts and expenditures, and, if the school is already in operation, the list of pupils.

In earlier days the subsidy was not usually granted until the school had proved its character and usefulness by its work. It now frequently happens, however, that the Government extends its aid to

schools from the date of their foundation. In return for subsidies granted the ministry requires that the schools shall each year transmit for its approval their accounts and their estimates for the ensuing year, and the changes which are to be made in the organic law and programmes; that they shall submit to governmental inspection, and that they shall adhere to the provisions of the organic law regarding the naming of members of the administrative commission and of the faculty.

Thus it is seen the Government really does exercise a control over schools after they have been subsidized. This control is not usually of a direct, active nature, however. As a general rule, if, in the inspection, a fault is discovered, no matter of what character, the ministry has but to indicate that a change is desirable and it is made. Otherwise the subsidy will probably be withheld, leaving the school in a crippled financial condition.

In granting aid the ministry of industry and labor has adopted the following general rules: For schools where the instruction is theoretical only, as in the industrial schools, a subsidy is given equal to one-third the total expenses of the school, after deduction has been made of any rent paid and the sum realized from tuition fees. For trade schools proper—that is, institutions teaching both the theory and practical manipulations of trades—the subsidy is equal to two-fifths of the total expenses, after deductions similar to the foregoing have been made. In the case of these schools, also, the Government pays half the expenditures for the equipment of the schools with the necessary tools and appliances. In the case of almost all the more important schools subsidies are also granted by the provinces and communes in which the schools are situated. A certain amount is also realized from gifts of individuals and industrial organizations.

As regards payments required of students, each school follows its own desires. In some instruction is gratuitous, in others a small entrance fee is required, while in still others a regular tuition fee is charged. With few exceptions, however, the payments required of students are very small and are well within the means of the laboring classes, from whom the students are mainly recruited.

An interesting feature of the policy of the Government toward technical education is the system for the regular inspection of all subsidized schools by a corps of expert inspectors attached to the ministry of industry and labor. At the head of this service is an inspector-general of industrial and trade education. Each subsidized school of the Kingdom belonging to this class of institutions is visited at least once a year by this officer or one of his assistants and a report made of the result. Similar inspections are made by the provincial authorities when the province subsidizes schools. The inspectors render assistance in bringing to the attention of the administrative commissions the experiences and practices of other schools. Unfortunately for the

purposes of the present investigation, these reports are not published. Only at considerable intervals of time are general reports regarding the conditions of industrial education in the Kingdom issued. The last report was published in 1897 and relates to the period 1884–85 to 1895–96. The two preceding reports were issued, one in 1886 and one in 1879. In consequence of this failure of the Government to issue annual reports, information regarding many of the schools could not be obtained for a later date than the school year 1895–96. The system, however, had become firmly established by that date, and later information, though desirable, would, if obtained, throw little additional light on the real character and spirit of the system as it now exists in Belgium. Most of the information regarding individual schools has been obtained from the last report of the Belgian Government (1897), and in but a few cases from direct reports of the schools. Of the industrial schools much valuable information of a later date has been derived from the official reports of the inspector of the province of Hainaut.

All schools described in the Government report are, or have been, subsidized. While there are some nonsubsidized schools in Belgium, they are neither numerous nor important. The Government reserves the right to refuse the subsidy if the school does not produce the desired results, or if the organic law or programmes are not adhered to or are not changed in accordance with the Government's desire, etc., but this right is not often exercised. In 1896 only three or four schools were refused the usual subsidy.

Schools may be established by communes, by private individuals, or in some cases by the provinces. Those under private direction are known as private schools (*écoles libres*), those under communal authority are called communal schools (*écoles communales*), and those established by the province are called provincial schools (*écoles provinciales*). All have the privilege of receiving subsidies if they meet the requirements imposed by the ministry of industry and labor.

Reference has been made to what is called the "organic law" of schools. This is an instrument which every Belgian institution described in this report, even the apprenticeship shops and trade courses, possesses. It is promulgated on the foundation of the institution and must be approved, along with other documents, before the ministry grants subsidies. It defines the nature and aims of the proposed school, provides for its government, defines the conditions upon which pupils will be received, provides for the nomination of an administrative commission, and defines its duties, etc. When the organic law is once approved by the Government it must remain in force until a change is officially sanctioned.

Although receiving State aid and being subject to State supervision the schools are essentially local institutions. Each school is supervised by an administrative commission composed usually of persons of

the neighborhood. Some of them, however, are appointed as representatives of the State and province. In this way the proper application of the subsidies is safeguarded. The mayor of the place where the school is located, or his representative, is in most cases the presiding officer by virtue of a provision of the organic law of the school.

These commissions each year arrange the programmes, audit the accounts, and make estimates for the ensuing year, establish the rules of the school, propose changes, etc., and give advice as to the appointment of the director and teachers. In the case of communal schools the commission is responsible to the communal council. The council is responsible to the provincial and State authorities after subsidies have been granted by the latter.

CLASSES OF INSTITUTIONS.

In a general way the great body of subsidized institutions described in the Government report may be divided into two broad classes — trade schools and industrial schools. There are a few institutions, however, which, although presenting features similar to those of trade schools, must be placed in a separate class, hence the classification adopted by the Belgian Government is used, with slight modifications, in this report. The classification follows:

INSTITUTIONS FOR FEMALES.

1. Trade schools, including (a) trade schools proper; (b) trade and housekeeping schools; (c) housekeeping and trade schools.
2. Housekeeping schools and housekeeping classes.
3. Trade courses.
4. Apprenticeship shops.

INSTITUTIONS FOR MALES.

1. Industrial schools.
2. Trade schools.
3. Superior trade and technical schools.
4. Saint Luke trade schools.
5. Apprenticeship shops (a) for stonecutting, (b) for weaving.
6. Trade courses.

In private schools the administrative commission is elected from the membership of the founding society, a society formed to look after the financial and other needs of the school. The commission in this case is directly responsible to the society.

The number of persons composing the commission varies in the different schools, but it is usually six. A recent ministerial circular directs that as far as possible the members shall be chosen from among the heads of industrial enterprises, engineers, and the like.

In communal schools the administrative commission is also expected to act as a committee of patronage to promote the welfare of graduates, recruit students for the various courses, interest employers in the

school, in order that they may encourage their employees to take the evening courses, and to induce parents to send their sons and cooperate in the effort to secure regular attendance, etc.

It will be noticed that in this classification there is no mention of technological institutes. Belgium, of course, possesses a number of such schools, but they are not considered as trade or industrial schools subject to the ministry of industry and labor, nor do they fall within the scope of the present report. No mention is therefore made of them. Each of the classes of institutions comprehended within the classification will be described in turn. As indicated by this designation, these institutions differ essentially in character. There is not one, however, that does not keep strictly in view the idea of preparing students to be able to earn their living by working in the particular branches of industry taught In no case must the instruction given be mistaken for that known as manual training.

To avoid repetition, it is well to observe the general conditions appertaining to these schools before passing to a consideration of each class. In the description of each class there will be mentioned whatever is interesting or peculiar in the methods of teaching, or in the organization, or whatever pertains particularly to the class which is being described.

Great importance is attached to drawing in all trade and industrial schools. Even in the trade schools for females drawing forms one of the principal branches of instruction. This drawing is given for a practical end and is taught with reference to its use in particular trades or industries. The report for 1897 says that it has been completely reorganized within a recent period, and placed upon a uniform basis for both trade and industrial schools. Pupils no longer draw after lithographs, but directly from models and machinery, and the drawing is based upon the study of projections and perspective.

Improvements have been introduced in other directions. The character of the instruction in general has been elevated, programmes have been revised, and the instructors are better paid and more capable. Most schools have collected fairly good libraries, and many of the older ones have good collections of models and scientific apparatus for demonstrations; but with the larger number, especially among the recently organized industrial schools, there is much room for improvement in this feature. Some of the older schools have large numbers of models made by pupils, some of which are donated from time to time to new schools.

As a means of developing the highest efforts of the students, nearly every trade or industrial school has a small museum in which is placed its best works. A public exposition of the work at the end of the year is a feature in most schools, especially in the trade schools. This is said to exercise a beneficial influence over the pupils and to

bring forth their best efforts. Another means adopted by a considerable number of schools with the same end in view is the granting of traveling scholarships to those who show the greatest ability in their work and examinations. These scholarships entitle the student to visit some industrial center for a short period of study in his special line of work. Generally the recipient is required to send in a written report of his observations.

The older schools are now established for the great part in comfortable quarters, many having buildings specially constructed for their purposes. The more recent schools, however, especially those belonging to the class known as "industrial," do not fare so well. In a number of cases the accommodations are inadequate.

Following is a description of each of the specified classes and their relationship to each other and to the system as a whole:

TRADE SCHOOLS FOR FEMALES.

The first class, that of the trade schools, represents the most advanced form of trade education for girls in Belgium. Three subdivisions are made.

The trade schools proper are those having the most complete programme, both in theoretical and practical work, the sole object being to teach the trades open to girls, at the same time carrying forward the ordinary school education begun in the primary schools. These schools have a general course which is obligatory for all pupils. This course generally includes such branches as French and Flemish, arithmetic, history, geography, hygiene, domestic economy, etc. Some schools include elements of the natural sciences, geometry, etc. The trades taught are necessarily limited in number. They include dressmaking and cutting, millinery, artificial-flower making, industrial drawing and ornamentation, painting (on glass, china, textiles, etc.), linen work (lingerie), embroidery, etc. Usually the general recitations are heard in the forenoon and the practical part of the trade teaching is done in the afternoon. In these schools housekeeping is not taught, except incidentally. There is no effort to prepare the student for earning her living by housework. This fact constitutes the main distinction between this and the other subdivisions of the trade schools, in which housekeeping plays a prominent part.

The trade and housekeeping schools have a less extended course, both in theoretical and in practical work, than do the trade schools proper, but considerably more time is given to instruction in housekeeping. This work includes mending, washing, ironing, cooking, etc. Instruction is given in the morning and afternoon, as in the trade schools proper. The general course is about the same as in the trade schools, but there are not so many trades taught.

The housekeeping and trade schools are not very important, there being but three of these institutions. In these schools the general

instruction is reduced to the minimum, only a few indispensable branches being taught, while the only thing taught in the way of trades is sewing and cutting of a simple character. The greater part of the time is devoted to household work, the principal aim of the schools being to prepare good housekeepers. Only to a slight extent is there any attempt made to enlarge the general knowledge of the students, accounting, hygiene, etc., being about the only branches taught. These schools form a sort of connecting link between the two preceding subdivisions and the housekeeping schools.

The trade schools proper for girls were the first trade institutions to make their appearance. They even antedate the first trade schools for boys. The first one was established in Brussels in 1865 by private effort. This school, which was more or less an experiment, was the outcome of efforts to ameliorate conditions confronting young girls who were compelled to enter the trades. It had long been apparent that girls learning their trades in the ordinary private apprenticeship shops were subjected to many unfavorable influences. Their education was neglected, all their time being required in the shops. Employers were frequently too ignorant to teach the trades properly, while others were opposed to the idea of allowing their apprentices to become thorough artists and possible competitors, and strove to keep them in inferior positions at low wages. It often happened that apprentices would be kept at one kind of work, in which they had become proficient, and were not given the opportunity to learn other branches. Again, necessity often determined the selection of the first opportunity that was presented, the result being that many girls were doomed to an occupation in which they showed no aptitude, and thus they were in no position to compete with their rivals after leaving the shops. Last, but not the least evil, was the low moral tone prevailing in some workshops.

A few public-spirited persons determined to attempt a reform, and, after careful consideration of the many problems that were presented, concluded to organize a trade school. This, it was thought, was the best medium through which to ameliorate such conditions. It could furnish pupils a special training in their chosen vocation, at the same time developing the general education begun in the primary schools. It was also argued that the girls would be left more or less under home influences, and that the trade school, everything considered, tended to furnish a better moral and mental equipment for their struggle in life than could be attained in the workshops.

By private donations a small sum was collected. A call was then issued to the public, which responded more or less freely, and to complete the work of establishing a school the Association for the Trade Education of Women was formed, the members agreeing to subscribe at least 36 francs ($6.95) each per year. Some of them donated much more. The communal council of Brussels agreed to purchase 100

scholarships at 36 francs ($6.95) each, that sum being the price first fixed for a year's tuition. These various sums were considered sufficient to meet ordinary running expenses, and for other expenditures, rent, furniture, etc., a large sum was donated by a friend of the movement, and the school was enabled to begin operations. At a later date the same person made a very large donation, which placed the school upon a firm footing. In 1868 it was recognized by the city as a communal institution entitled to subsidies, and the same year it began to receive contributions from the State. This school proved successful, and many of the teachers who now hold positions in other trade schools were graduated from this institution.

In 1873 a second school was created, also in Brussels, and by private initiative. It became communal in 1882. In 1874 a third trade school for girls was created, located at Antwerp. It was also a private school, but was taken over by the commune in 1879, and first received a subsidy from the Government in 1880. A few years later schools were opened in Mons and Verviers. The movement was now well started and trade schools for girls sprang up in several parts of the Kingdom. The trade and housekeeping and the housekeeping and trade schools did not appear until a decade later.

The schools of these three subdivisions are intended for the daughters of clerks, artisans, small merchants, and even of persons of the middle class. Although there is a wide difference in the programmes of these schools, the object is the same in all—to prepare young girls to earn a livelihood.

In all the above subdivisions of the trade schools the recitations and exercises are held every week day (Saturday excepted in some cases). Sessions are held both in the forenoon and afternoon. The hours per day are about the same as in the public schools in the United States. The duration of courses of study is not uniform even for schools of the same subdivision. In the trade schools proper it is from three to four years, one school reporting five years. The trade and housekeeping schools require three and four years of study, while the housekeeping and trade schools require two and three years.

All these schools are either communal or private. They may be subsidized to the amount of two-thirds of their ordinary expenses. The total receipts of these institutions in 1896 was 344,478 francs ($66,484). Of this amount the contribution of the State was 93,303 francs ($18,008); that of the provinces was 18,462 francs ($3,563), and that of the communes was 99,826 francs ($19,266). The balance represents the amount derived from tuition fees, donations, etc. Trade schools for girls have shown a remarkable growth in the last six years. In 1896 there were only 23 schools in the three subdivisions, while on December 31, 1901, there were 46. The locality of these 46 schools is shown in the following list, which was furnished by the ministry of industry and labor:

TRADE SCHOOLS PROPER.

Communal schools: Antwerp, Brussels (2), Ghent, Ixelles, Mons, Verviers; total, 7.

Private schools: Diest, Enghien, Frameries, Ghent, Grammont (2), Hal, Ixelles (2), Jodoigne, Laeken, Liege (2), Louvain (2), Malines, Molenbeek, Nivelles, Saint-Gilles, Josse-Ten-Noode, Schaerbeek, Uccle, Vilvoorden; total, 23.

TRADE AND HOUSEKEEPING SCHOOLS.

Communal schools: Saint-Gilles, Schaerbeek; total, 2.

Private schools: Braine-la-Leude, Brussels (2), Etterbeek, Gosselies, Heverlé, Hougaerde, La Louviere, Lierre, Quievrain, Saint-Trond; total, 11.

HOUSEKEEPING AND TRADE SCHOOLS.

Communal schools: Ath, Laeken, Tournay; total, 3.

In 1896 there were 15 trade schools proper, 6 trade and housekeeping schools, and 2 housekeeping and trade schools, while the above list shows that there are now 30 trade schools proper, 13 trade and housekeeping schools, and 3 housekeeping and trade schools.

The following table compiled from the report of 1897 shows for each school the year when the school was created, the subsidies and other receipts, length of course, and the number of teachers, students, and graduates during the year 1895–96:

RECEIPTS, TEACHERS, STUDENTS, AND GRADUATES OF TRADE SCHOOLS, TRADE AND HOUSEKEEPING SCHOOLS, AND HOUSEKEEPING AND TRADE SCHOOLS FOR GIRLS, 1895–96.

Locality and kind of school.	Year established.	Subsidies granted in 1895-96 by the—			Other receipts.	Total receipts.	Length of course (years).	Number of teachers.	Number of students.	Graduates during year.
		State.	Province.	Commune.						
TRADE SCHOOLS PROPER.										
Communal schools:										
Antwerp	1871	$2,534	.....	$2,535	$5,044	$10,113	5	23	279	16
Brussels (rue du Marais)	1865	1,255	$290	2,219	5,539	9,303	4	22	242	13
Brussels (rue du Poinçon)	1873	2,084	251	2,219	2,644	7,198	4	19	295	33
Ghent	1889	1,158	386	1,288	700	3,532	3	13	160	17
Ixelles	1889	579	96	2,403	58	3,136	3	8	140	6
Mons	1879	1,486	579	2,008	366	4,439	4	14	105	7
Verviers	1886	869	386	888	800	2,943	4	10	186	12
Private schools:										
Grammont (rue du Couvent)	1896	282	58	.....	365	705	3	6	86	.....
Grammont (rue de la Denvre)	1893	556	.....	.....	830	1,386	4	8	103	3
Ixelles	1891	697	.....	.....	1,046	1,743	4	8	157	10
Lessines	1893	289	.....	.....	471	760	3	4	18	.....
Louvain	1891	231	39	.....	444	714	3	13	81	14
Saint-Gilles	1896	205	.....	.....	307	512	3	.....	12	.....
Schaerbeek	1891	531	.....	.....	887	1,418	3	9	158	2
Uccle	1893	366	77	.....	289	732	4	9	62	5
TRADE AND HOUSEKEEPING SCHOOLS.										
Communal schools:										
Saint-Gilles	1891	811	386	1,088	1,621	3,906	.....	12	90	5
Schaerbeek	1889	417	193	1,725	39	2,374	.....	6	69	3
Private schools:										
Braine-la-Leude	1893	540	.....	97	1,013	1,650	.....	8	60	6
Brussels (rue de Terre Neuve)	1888	1,351	386	1,351	1,666	4,754	4	12	110	3
Brussels (rue de la Roue)	1890	815	135	1,075	502	2,527	4	11	75	3
Heverlé	1887	444	.....	.....	926	1,370	.....	7	175	(a)
HOUSEKEEPING AND TRADE SCHOOLS.										
Communal schools:										
Ath	1893	197	98	197	.....	492	3	2	48	.....
Tournay	1890	311	203	173	90	777	2	4	36	(a)
Total	.....	18,008	3,563	19,266	25,647	66,484	.....	228	2,747	b 158

a Not reported.

b Not including 2 schools not reporting.

HOUSEKEEPING SCHOOLS AND HOUSEKEEPING CLASSES.

The second class in the list of institutions for the trade education of girls includes what are known as the housekeeping schools and housekeeping classes. Probably the terms "schools and classes of domestic economy" would more aptly express the purpose for which these institutions were created. In them the instruction relates only to domestic duties, and consists for the greater part of practical exercises.

These schools are intended for girls of the laboring classes, and while primarily designed to fit girls for the proper care of their own homes, the effect of the instruction received is to prepare them for entering domestic service as laundresses, cooks, housekeepers, etc. They probably constitute the most interesting class of scholastic institutions in Belgium. While they are interesting as educational institutions they are much more so as social institutions. In the great movement to improve the condition of the poorer classes it became evident that if permanent good was to be accomplished attention must be given to the way in which the working classes expended their earnings, as well as to the means for increasing these earnings. It was noted that in many cases the poor conditions under which workingmen were living were due as much to the wasteful way in which their earnings were spent, to the faulty manner in which their food was prepared for the table, to the absence of proper care of the household, to the nonobservance of even the most elementary rules of health and hygiene, to the poor way in which clothing was made or repaired and the lack of judgment regarding its suitability to different seasons and characters of work, etc., as to the smallness of the incomes earned.

To remedy this condition of affairs, it was necessary that the housewives should be awakened to the possibilities of improved methods of housekeeping as a factor in the welfare of themselves and their families. For this purpose a manufacturer of Coullet in 1872 established a school of housekeeping for the daughters of his workmen, and in 1874 a similar institution was started at Frameries. These institutions served as models for others, and when the labor commission of 1886 made its detailed report on labor conditions it commended the work of these schools and advised the creation of others.

The Government took up the matter with great earnestness, and by a royal order of June 26, 1889, it created a central committee of patronage, with the Countess of Flanders as president. This committee had charge of the work of propaganda. On the same date the Government issued a circular to the governors of the provinces calling on them to devote as great efforts as possible to the development of schools for teaching housekeeping, at the same time indicating the general lines along which it was believed such schools should be organized. Finally, the Government promised its financial assistance

to all proper efforts set in action by the provinces or communes. On July 6, 1890, another royal order created a special committee of propaganda in each province.

On January 21, 1899, a new circular was issued to the governors of the provinces, replacing the one issued ten years before. This circular was designed to set forth what, according to the opinion of the Government, should be the character and organization of the housekeeping schools. In this circular the minister of industry and labor gives the following statement regarding the programme of studies and work that should be adopted by the schools:

I have no intention of imposing an obligatory programme upon the promoters of schools or housekeeping classes. This programme must necessarily adapt itself to the customs and needs of the people. It can not be the same in agricultural districts and industrial centers. However, the experience that has been acquired furnishes certain general indications that it would be prudent to take into account. The programme should be simple and practical. It would be well to include:

I. As theoretical courses—(1) Lessons in hygiene relating to the care to be given in case of slight accidents, the symptoms of diseases of children, the proper means of preserving health, the care of children, sick persons, and old persons, the preparation of health foods, a knowledge of the use and curative properties of the few remedies constituting the domestic pharmacy, the care of sick rooms, etc. (2) Principles of domestic economy. (3) Principles of domestic accounts. (4) The methods of washing. (5) The methods of ironing. (6) The methods of cleaning. (7) The nutritive value of certain food products, the properties of certain vegetables, and the principles of cooking.

II. As practical exercises—(1) The care of the house and furniture, the care of sleeping rooms, floors, etc., and the household work that must be done each day, week, or season. (2) The washing of linens, clothing, stockings, etc.; the manner of removing stains made by ink, tar, fruit, paint, etc., as well as the precautions to be taken during and after washing; the washing of flannels, woolen stuffs, etc. (3) Ironing; recommendations regarding the table, the irons, and fire; the folding and arranging of linen. (4) The kitchen; series of cheap meals coming within the limitations of the workman's budget, and offering a healthy, nourishing, and varied assortment of dishes; methods of making use of vegetables, meats, etc., that are left over. (5) Manual exercises; the mending and preserving of all sorts of clothes and linen articles, the darning, piecing, etc., of stockings; the utilization of old articles should be specially taught; the purchase of the material and subsequent cutting and making of bed linen, chemises, plain clothing, working clothes, etc.; the net cost of all articles made should be determined. (6) Finally, for the rural communes instruction in vegetable gardening and the care of the yard or court should be included.

The housekeeping schools are those having a regular organization, as is the case with other schools. The housekeeping classes are modifications of the school, to meet special conditions. The schools are regarded by the Government as being essentially trade schools. They

are either communal or private, and admit only girls of 14 years of age or over.

The housekeeping classes are of three kinds: (1) Those annexed to primary schools, which are intended for girls of 12 years of age or over; (2) those annexed to higher schools, for girls of 14 years or over; and (3) special classes, also for girls of 14 years or over. Classes may be either communal or private. They are largely attended by older girls who are already engaged in industrial or other occupations and who have no opportunity to attend the regular housekeeping schools. The programme is the same as in the schools, except that the courses in sewing and cutting are optional.

The schools are open from 4 to 6 days a week, two sessions, each of 2½ to 3 hours, being held each day. In the housekeeping classes there must be at least two sessions a week, each of 2½ to 3 hours. Practical exercises are preceded by an explanation of the theory of or reason for the operation. The duration of the studies has been variable, but the ministerial circular of January 21, 1899, contains the following provisions: In those schools which are open but 4 days a week the complete course of instruction shall cover a period of 2 years. In those schools open every day the complete instruction may be given in 1 year. In the housekeeping classes the course will be completed in 2 years. The length of term in each of the schools shall be not less than 6 months, and for the classes it must be 9 or 10 months in cities and 6 or 7 months in the rural districts.

In granting subsidies the Government exacts the same conditions as in the case of other trade schools. When the conditions are properly observed subsidies amounting to two-fifths of the ordinary expenses are allowed, both to the schools and classes. The total receipts of these institutions in 1896 were 250,867 francs ($48,417). Of this sum 92,137 francs ($17,782) were received as subsidies from the State, 26,074 francs ($5,032) were provincial subsidies, and 59,008 francs ($11,389) represented the amount paid by the communes. Other receipts amounted to 73,648 francs ($14,214).

These schools constitute one of the most important features of the system of trade education in Belgium, and that they are appreciated by the classes for whose benefit they were established may be inferred from the fact that during the year ending December 31, 1901, there was an attendance of 9,791 students in the 277 schools and classes in operation, while the services of 636 teachers were required, and 823 certificates, showing that the recipients had completed the prescribed course of exercises and study, were issued.

These schools and classes have shown a remarkable growth. In 1888 there were but nine in existence. After the ministerial circular of June 26, 1889, which promised the Government's aid, was issued, there was an immediate increase, the number reaching 35 in 1890. From

that date there was an increase each year until on December 31, 1900, there were 278 institutions. This number was reduced to 277 during the following year. Slight fluctuations, however, are common, even in the course of a month or two, for new classes or schools are always being formed and others abandoned. Thus, in the list of schools furnished in 1900 by the ministry of industry and labor there are shown a total of only 275 schools and classes in active operation. They are tabulated as to kind of school or class, and by provinces, as follows:

HOUSEKEEPING SCHOOLS AND HOUSEKEEPING CLASSES, 1900.

Province.	Housekeeping schools.			Housekeeping classes.				
	Communal.	Private.	Total.	Communal.	Private.	Annexed to primary schools.	Other classes and courses.	Total.
Antwerp	3	2	5	4	14	6	.....	24
Brabant	2	10	12	15	13	.....	2	30
West Flanders	2	1	3	2	19	1	1	23
East Flanders	.....	.....	.....	9	13	13	.....	35
Hainaut	13	20	33	15	12	.....	.....	27
Liege	2	11	13	25	3	.....	.....	28
Limbourg	.....	1	1	.....	12	2	.....	14
Luxembourg	1	2	3	3	3	.....	.....	6
Namur	2	6	8	4	6	.....	.....	10
Total	25	53	78	77	95	22	3	197

TRADE COURSES FOR FEMALES.

The class of "trade courses" covers a few cases where regular trade schools have not been created, but where special courses in trades have been arranged in connection with other institutions. Of these the most important is the advanced course in dressmaking given in Brussels for the benefit of graduates of the trade schools who desire to become dress designers as well as dressmakers, or to pursue their instruction further than can be done in the trade schools. This course was organized in 1895 by the ministry of industry and labor, and is the only case where the Government has directly established an institution of the character with which this report is concerned. The schools having these trade courses are as follows: Brussels, course in the history of costumes (for graduates of trade schools); Josse-Ten-Noode, rue Musin (communal); Josse-Ten-Noode, rue de la Limite (communal). A short description of each is given in its proper place.

APPRENTICESHIP SHOPS FOR FEMALES.

The class of apprenticeship shops is of little importance. There are but four such shops, and they have been established in response to particular needs rather than as part of a regular scheme of industrial training institutions. That which distinguishes these shops from trade schools is the effort made to combine trade instruction with industrial work for financial remuneration. It is sought in this way to assist young girls who are forced to earn their own living. Work

is either furnished by outside parties and paid for at the usual rate, or the products of the girls' work is disposed of in the open market in one way or another. Of the four shops one, at Jemelle, is a communal institution. The other three, which are private shops, are located in Bassenge, Malveghem, and Saint-Trond. The last three mentioned are shops for straw working, embroidery, and lace making, respectively. The straw-working shop at Bassenge is for pupils of both sexes.

INDUSTRIAL SCHOOLS.

By the term industrial school (*école industrielle*), as used in Belgium, is meant a continuation school in which is taught a number of scientific or technical subjects relating to industrial work. There are no manual exercises such as are practiced in trade schools, the instruction being of a purely theoretical nature. These schools constitute the largest and most important class of institutions that exists in Belgium for the technical training of young men. Their purpose is to give the workman an opportunity to acquire at least elementary instruction in the principles involved in various industrial operations, or in the trades practiced in the locality. Regarding the object of these schools the report on trade and industrial education published by the Belgian Government in 1886 says: "The object of the industrial school is to give the workman scientific instruction which he can not acquire in the shops, and to enlarge his understanding by imparting to him a knowledge of the general laws which govern the transformation of matter, in order that he may be gradually released from the tyranny of routine work and provided with the means of increasing the economic value of his labor."

These schools are especially adapted to the needs of those already engaged in trades or industrial work, the instruction being given outside of working hours. They are thus industrial continuation or complementary technical schools. They do not pretend to teach the practical part of particular work or trades to young boys as do the trade schools, and although their programmes are so arranged that boys may prepare themselves to enter particular trades, with a good knowledge of the theory involved, these schools appeal more particularly to those already employed. Regarding the fitness of the instruction given in these schools, the report above quoted says: "The instruction that the workman receives in these schools and the good advice that is given exercise a great influence on his future. The industrial school constitutes a great means of developing the people and aiding their progress."

Industrial schools have a long history. They are the oldest class of institutions in Belgium with which this report is concerned, some of them dating from the early part of the nineteenth century. Many had their origin in the old schools and academies of design, which were

later enlarged by the addition of industrial courses. In other cases the drawing school was suppressed and the industrial school founded in its stead.

Industrial schools are essentially local institutions. Their programmes are arranged strictly with reference to local needs—that is, the character of local industries or trades practiced—hence, wide variations are to be observed in the special branches taught. In general the programmes include a groundwork of instruction in drawing, with its various applications, arithmetic, algebra, geometry, physics, chemistry, mechanics, elements of accounting, hygiene, and industrial economy, while as specialties they include, according to local needs, one or more such branches or general subjects as building construction, shop technology, metallurgy, electricity, theory of stonecutting, exploitation of and plans for mines, industrial chemistry, steam engineering and firing, construction of works, surveying, weaving, dyeing, painting in imitation of marble and wood, etc. This list does not include half the subjects and specialties taught, but those mentioned are the ones most frequently found in the programmes. When it is considered that by far the greater number of students comes from the working classes, whose primary education is often sadly deficient because of the early age at which they must go to work, the list appears rather formidable, but as one of the provincial inspectors explains, "it is understood that one is to lay stress only upon those elements of which the students may be able to make use in their respective callings."

A large number of schools have a commercial course in connection with the industrial courses, hence many take the name industrial and commercial schools. In this class are also a number of institutions having trade sections in which, in some cases, practical as well as theoretical work is done. There is only one industrial school (Tournay) whose special organization warrants its being called a trade school. The distinction between it and a trade school proper is mentioned in another place. A few of the schools that had their origin in the old drawing schools and academies of design have received the name "combined industrial and drawing school."

Drawing is a conspicuous feature of the scheme of instruction in all industrial as well as trade schools. Sketches are made directly from the machines or from models. Drawing after lithographs is seldom done at present.

Although the minimum age of admission is usually placed at 14 years, nearly every school admits pupils of 12 or 13 years if they have certificates showing that they have finished the studies in the primary schools. Students not having such certificates are usually required to pass an entrance examination in reading, writing, arithmetic, etc.

In the industrial schools instruction is given in the evening or on

Sunday. There are, however, one or two schools where there is a departure from this rule. In those excepted cases recitations are, for a part of the year, held on week-day mornings before working hours. The length of each evening session is generally two hours, and that of the Sunday sessions three hours. The number of sessions held during the week varies. Some schools have six evening sessions a week and one on Sunday morning; others have three, four, or five evening sessions and one on Sunday; still others have a variable number of evening sessions but none on Sunday; while in a few schools all the instruction is given on Sunday morning.

In the best organized schools, after the student has spent from one to three years in a preparatory or general course he may enter one or more distinct departments, each department including a number of obligatory studies bearing on some special branch of industry. Thus the specialties "shop technology," "exploitation of mines," "construction of works," etc., are distinct departments in most schools.

In those schools having both week-day and Sunday sessions, the programme is often arranged so that some courses (or departments) are taught only on Sunday and others only in the evening. Occasionally the same department will appear in both programmes. The effect of this arrangement is much the same as if there were two distinct schools.

The school year begins about the first of October in most schools. There is no uniformity as to its length. In a few schools the term ends in April and May, but the larger number of schools close in July or August. There is no uniform rule with regard to duration of the course of study. In about half the schools it is three years, and in the remainder it is four and five years. In most schools there is a preparatory course of from one to three years before the student specializes in one of the departments.

In general, tuition in the industrial schools is free. In most cases, however, the administrative commission has fixed a small entrance fee. This has been done, not as a means of increasing the receipts of the school, but to insure a more regular attendance. This policy has produced good results. In some schools the fee is returned at the end of the year if attendance has been regular, but in most schools the sum realized from entrance fees is distributed in the form of prizes at the end of the year.

Many of the schools have large collections of models, instruments, etc., which are carefully listed and used during the lectures. In the best organized schools class visits to industrial establishments are made under the direction of instructors. These visits are not so numerous, as a rule, as they are in the trade schools. In quite a number of cases graduates have formed associations in aid of the work of their school.

A few industrial schools are housed in buildings specially constructed for their use, but in most cases the buildings of the intermediate schools are used. The industrial schools are governed by an administrative commission in the same manner as the other classes of schools.

In schools of this character there is of necessity a large percentage of withdrawals during the school term. This is partly explained by the migratory character of industrial populations. No figures showing the extent of this defection can be obtained for all schools of this class, but for the 30 schools in the province of Hainaut it amounted in 1900 to from 9 to 50 per cent, the average being about 26 per cent. This percentage of loss is probably too high for the entire kingdom.

The number of industrial schools is rapidly increasing. In 1896 there were but 40, while on December 31, 1901, there were 70. Attendance has also increased. In 1896 there were 13,015 students enrolled, and in 1901 there were 20,733. In a number of schools females are now admitted, but the number in attendance is small. There were 727 girls enrolled in all the industrial schools in 1901. They are usually attracted to the commercial courses.

The following list shows the location of 68 of the 70 industrial schools in 1901. Of the 68 schools, 59 were communal, 4 were private, and in 5 cases the status was not known:

INDUSTRIAL SCHOOLS.

Communal schools.—Alost, Anderlecht, Anderlues, Antwerp, Arlon, Ath, Boussu, Braine-le-Comte, Bruges, Brussels, Charleroi, Châtelet, Courcelles, Courtrai, Dinant, Dour, Fleurus, Fontaine l'Evêque, Frameries, Furnes, Ghent, Genappe, Gosselies, Hasselt, Houdeng-Aimeries, Huy, Jemmapes, Jumet, Laeken, La Louvière, Lessines, Leuze, Liege, Lokeren, Louvain, Marchiennes au Pont, Marcinelle, Mons, Montigny-sur-Sambre, Morlanwelz, Namur, Neufchâteau, Nivelles, Ostend, Pâturages, Peruwels, Quaregnon, Quiévrain, Saint-Ghislain, Saint-Nicolas, Schaerbeek, Seneffe, Seraing, Soignies, Tournay, Verviers, Vilvoorden, Walcourt, Ypres; total, 59.

Private schools.—Brussels, Malines, Tamines, Turnhout; total, 4.

There are also schools at Andenne, Binche, Court Saint-Etienne, Grammont, and Wasmes, but it is not known whether they are communal or private.

Industrial schools that comply with the requirements of the Government are entitled to subsidies, amounting generally to one-third the total expenditures, after deduction is made of the income from tuition or entrance fees and the amount paid for rent. This latter item is regarded as an expense for which the commune or the private founders are responsible. In 1895–96 the State paid subsidies to the amount of 250,581 francs ($48,362) to 39 of the 40 industrial schools then in existence. The same 39 schools were subsidized by their respective provinces to the amount of 124,302 francs ($23,990), and by the communes to the amount of 242,639 francs ($46,829). Receipts from

entrance fees, etc., amounted to 40,457 francs ($7,808), bringing the total receipts up to 657,979 francs ($126,989).

While the trade school may give more satisfactory results to a limited number of students, it fails entirely to reach the great mass of laborers who begin work sometimes long before they have finished their primary studies. Hence it may be said that in the matter of attendance, the character of the students reached, and the results attained the industrial school fills a place that under present conditions can be filled by no other. These facts are well illustrated in the following table, derived from the official report of 1897, which gives for the period 1884–85 to 1895–96 the number of students in attendance, classified by age groups and by character of employment. It shows that a large majority of the students were above the ordinary school age. Of the 13,015 students in attendance in 1895–96, 7,766 were 16 years of age or over, and 2,697 were 20 years of age or over. As to character of employment, it was found that in 1895–96 a very large majority of the students (namely, 8,555) were classed as workingmen, while 2,313 were employed in office and clerical positions, 1,571 were students in other schools, and 586 were without employment. This shows to what extent these schools are attended by those in actual employment.

ATTENDANCE AT INDUSTRIAL SCHOOLS FOR BOYS, 1884–85 TO 1895–96, BY AGE AND CHARACTER OF EMPLOYMENT.

Years.	Ages.					Character of employment.				
	Under 14 years.	14 to 16 years.	16 to 20 years.	20 years or over.	Total.	Workingmen.	Office and clerical positions.	Students in other schools.	Without employment.	Total.
1884–85	823	2,856	3,449	2,043	[a]9,171	6,169	1,454	1,185	362	[a]9,170
1885–86	936	3,027	3,338	2,177	9,478	6,263	1,490	1,355	370	9,478
1886–87	977	3,097	3,956	2,130	10,160	6,713	1,689	1,343	415	10,160
1887–88	1,077	3,155	3,854	2,244	10,330	6,865	1,763	1,335	367	10,330
1888–89	1,239	3,351	4,148	2,546	[a]11,284	7,544	1,961	1,355	434	[a]11,294
1889–90	1,337	3,726	3,406	2,570	[a]11,039	7,185	2,013	1,464	387	[a]11,049
1890–91	1,296	4,019	4,457	2,635	12,407	8,560	1,877	1,597	373	12,407
1891–92	1,385	3,894	4,876	2,758	[a]12,913	9,030	1,950	1,511	432	[a]12,923
1892–93	1,471	3,817	4,826	2,736	[a]12,850	8,593	2,265	1,512	473	[a]12,843
1893–94	1,403	3,881	4,868	2,665	[a]12,817	8,502	2,112	1,617	587	[a]12,818
1894–95	1,199	3,615	4,825	2,584	12,223	8,056	2,110	1,485	572	12,223
1895–96	1,334	3,915	5,069	2,697	[a]13,015	8,555	2,313	1,571	586	[a]13,025

[a] The totals for ages and character of employment do not agree; the figures are given, however, as they appear in the official report.

The following table, derived from the official report of 1897, shows for each school the year when the school was created, the subsidies and other receipts, the duration of the courses of study, and the number of teachers, pupils, and graduates. The schools are all communal except the one at Tamines, which is a private institution:

RECEIPTS, TEACHERS, STUDENTS, AND GRADUATES, INDUSTRIAL SCHOOLS FOR BOYS, 1895-96.

Locality.	Year established.	Subsidies granted in 1895-96 by the—			Other receipts.	Total receipts.	Length of course (years).	Number of teachers.	Number of students.	Graduates during year.
		State.	Province.	Commune.						
Anderlecht	1881	$291	$125	$586	.....	$1,002	5	12	251	(a)
Antwerp	1860	1,897	869	2,926	.....	5,692	5	17	348	5
Arlon	1872	311	173	448	.....	932	5	10	114	(a)
Ath	1871	385	289	422	$58	1,154	5	7	200	2
Boussu	1894	270	270	270	.....	810	3	4	93	.....
Bruges	1855	(b)	(b)	(b)	.....	(a)	(a)	6	20	(a)
Brussels	1869	11,409	1,930	9,091	1,737	24,167	3	16	523	23
Charleroi	1845	1,930	1,930	772	1,337	5,969	3	25	952	78
Châtelet	1870	745	598	794	.....	2,137	3	18	883	64
Courtrai	1866	1,031	952	1,110	.....	3,093	4	13	412	12
Dour	1895	415	415	405	97	1,332	4	8	116	2
Fontaine l'Evêque	1887	346	386	206	276	1,214	3	9	294	15
Furnes	1869	142	90	195	.....	427	4	8	71	(a)
Ghent	1833	6,440	869	3,219	965	11,493	3	24	918	65
Gosselies	1881	379	398	398	.....	1,175	3	9	224	9
Hasselt	1864	286	58	515	.....	859	5	9	118	(a)
Houdeng-Aimeries	1864	456	579	302	87	1,424	3	6	149	25
Huy	1838	769	579	958	.....	2,306	5	8	243	4
Jemmapes	1880	637	434	483	87	1,641	4	9	353	16
Jumet	1870	692	579	756	48	2,075	4	13	326	(a)
La Louvière	1888	786	786	786	.....	2,358	3	16	502	40
Liege	1825	2,263	1,002	3,860	.....	7,125	3	15	660	44
Louvain	1876	1,345	733	1,849	96	4,023	3	16	324	16
Marchiennes au Pont	1873	643	579	708	97	2,027	3	12	352	30
Morlanwelz	1871	1,219	859	965	743	3,786	4	18	647	50
Namur	1861	870	817	870	2	2,559	4	16	416	(a)
Nivelles	1818	457	58	855	.....	1,370	5	8	103	(a)
Ostend	1867	739	241	1,219	.....	2,199	3	14	152	(a)
Pâturages	1868	585	579	592	.....	1,756	4	7	266	(a)
Saint-Ghislain	1868	579	579	540	.....	1,698	4	8	331	20
Saint-Nicolas	1886	386	193	386	330	1,295	3	6	46	17
Schaerbeek	1891	586	64	1,028	.....	1,678	5	13	204	(a)
Seraing	1858	1,215	965	1,465	370	4,015	4	18	375	(a)
Soignies	1859	348	328	325	.....	1,001	5	10	151	(a)
Tamines	1893	116	96	96	66	374	3	6	80	.....
Tournay	1860	c1,351	c1,351	c1,351	c183	c4,236	3	12	193	(a)
Verviers	1862	4,852	2,426	4,851	959	13,088	3	19	572	(a)
Vilvoorden	1889	352	193	512	.....	1,057	5	8	157	(a)
Walcourt	1893	318	97	193	270	878	3	4	98	.....
Ypres	1865	521	521	522	.....	1,564	5	10	171	(a)
Total	.....	48,362	23,990	46,829	7,808	126,989	.....	467	12,408	d537

a Not reported.
b No subsidy received in 1895-96.
c Including apprenticeship shops.
d Not including 17 schools not reported.

TRADE SCHOOLS FOR MALES.

In these schools, as their name implies, the object is to teach the practical work of the trades as well as the necessary amount of theory. Hence the instruction includes manual exercises; in other words, apprenticeship in trades. In this respect they differ greatly from the industrial schools, in which it is seen the scheme of instruction does not include manual exercises.

The question of apprenticeship has been much discussed in Belgium, and there has been until recently a general conviction that it should be confined to the private workshops, or at least that the ordinary apprenticeship system should not be wholly supplanted by the trade schools. In the past great objection to the establishment of trade schools has been their relatively high cost, both in the matter of installation and of maintenance, as compared with the industrial schools. Another obstacle to be met in the case of trade

schools supplanting private apprenticeship has been the unwillingness on the part of the pupil or his family to submit to the loss in wages which an apprenticeship in a trade school would almost necessarily entail.

For these reasons, to which have often been added the apathy or opposition of the working classes and employers, the formation of trade schools was long delayed, reliance being placed in the ordinary apprenticeship, supplemented by the industrial schools, for the evolution of the complete workman. Thus the industrial schools held undisputed sway for many years.

The trade school is an institution which has but recently made its appearance in Belgium, but as early as 1860 there was organized at Tournay an industrial school upon lines very similar to those of the trade schools. While it is classed as an industrial school, it has annexed a number of apprenticeship shops for wood and iron working, in which the student may serve a regular apprenticeship. This school differs from the trade school in that the apprenticeship is not obligatory upon all students, nor is attendance upon the purely industrial part of the instruction required of all apprentices.

The first trade school proper was established by the initiative of the master tailors of Brussels, and was opened to apprentices in 1880. It now receives subsidies from the State. The next school was established at Ghent in 1887 by the communal authorities, its object being to produce a high class of workmen in the wood and metal trades. In 1888 three trade schools were opened, viz, a printing school in Brussels, a tailoring school in Liege, and a fishing school in Ostend. From this beginning there was a gradual increase until, when the Government report of 1897 was issued, there were 12 trade schools besides the apprenticeship shops of the industrial school of Tournay. In 1901 the number had increased to 36. The 12 schools reported in 1897 are the only ones for which there is information at hand, and what is said in succeeding paragraphs is based upon this somewhat limited material. The consideration given them is justified, however, because of their rapidly increasing importance.

These schools owed their origin to the pressing need of skilled, all-round workmen in many of the trades. The tendency in the private establishments was too much toward specialization to allow workmen the opportunity of learning more than certain branches of particular trades, and, moreover, it involved a loss of wages when a workman was transferred, voluntarily or involuntarily, from one branch where he had gained efficiency to another in which he was deficient, or of which he was totally ignorant. It was much the same as learning a new trade. The remedy proposed was the apprenticeship in trade schools, where the apprentice would become familiar with all branches of his trade in order to prepare himself to pass readily from one class

or work to another. Most of the schools have been created through private effort. Sometimes the initiative has been taken by individuals, sometimes by trade unions, and again by employers' associations. Occasionally the initiative has been taken by an individual with the cooperation of a trade union, or by a trade union with the cooperation of an employers' association.

These schools do not undertake to teach such a diversity of subjects as do the industrial schools. Trade schools are sometimes founded for the purpose of teaching the theory and art of a single trade, as, for instance, the tailoring schools. Others have a more extended programme and teach several trades, as in the Nicaise school at Ghent. In some schools there is no general course of study aside from the theories pertaining to trades and the drawing applicable to them, while in others there is a well-defined general course, including such subjects as arithmetic, algebra, geometry, French, Flemish, geography, and mechanics. In each school the theory of the trade receives proper attention. This sometimes consists of an explanation of what is to be done during the session, what material is necessary, what process is to be used, why one process rather than another should be used, etc. In other schools the theory is carried much farther and includes study of the source, production, supply, preservation, and market value of materials and tools, and historical changes in fashions, etc.

With regard to the hours of study or work we find two distinct classes of trade schools. In one class the school apprenticeship is intended to supplant entirely that of the shops. In such schools the apprentices work all day, with intermissions for lessons in theory. Notable cases are the tailoring schools at Brussels and Liege, and the Nicaise metal and woodworking school at Ghent. In the other class of schools the instruction is given at night, either every day or on certain days of the week, one school having a Sunday session and two night sessions during the week.

This latter class of schools is generally intended only for apprentices in the trades and should be considered as continuation schools rather than trade schools proper. Their aim is to give the apprentice a wider knowledge of the theory of the trade than can be gained in the shops, to elevate his taste, develop his initiative, etc. In these schools practical work is also done, which fact distinguishes them from industrial schools. The evening (or continuation) trade schools are open from 6½ to 12 hours per week and the regular trade schools are open from 48 to 63 hours per week.

The fishing schools form a class by themselves. No complete apprenticeship could be served in these schools, but practical work is done in the way of repairing sails, nets, boats, etc. These schools have their programme arranged to suit the convenience of the students. Thus, one

school is open only in the evening for 12 hours a week, in one instruction is given both day and evening for 12 hours a week, and one has two regular daily sessions of 3 hours each. In this latter school the programme of general studies is more highly developed, the idea being to form a superior class of fishermen having a scientific knowledge of the seas, the management of boats and machinery, the use of instruments, etc.

The duration of studies varies in the different trade schools. In one of the fishing schools it is 2 years; in the printing school of Brussels it is 5 years, while in the remaining schools it is 3 and 4 years.

The price of tuition has been one of the serious questions with the trade schools. In most cases if it were placed at a figure in any degree commensurate with the cost of installing and maintaining the school the class of people for which trade schools are primarily intended would be excluded. Hence, every effort is made to avoid a high rate of tuition, and the employers' associations, communes, and individuals that have founded trade schools have in most cases preferred to assume greater liabilities by making the fees very small or requiring nothing at all. In the two tailoring schools there is an entrance fee of 50 francs ($9.65) and a tuition fee of 12 francs ($2.32) per year. In only one school, the watchmaking school at Brussels, is the tuition fee to be considered high, that is 250 francs ($48.25) a year.

On account of the greater expense of installation and operation the trade schools are more highly subsidized than are the industrial schools. Their subsidy amounts to two-fifths of the expenditures after deducting the amount received in the way of tuition fees, and not including the rent of buildings. Subsidies are in most cases allowed by the commune and province in which the school is situated. Only 11 of the trade schools had been in operation long enough to receive subsidies before the Government report for the period ending with 1896 was issued. During that year the State subsidy amounted to 28,470 francs ($5,495). The communes subsidized 8 schools to the amount of 26,991 francs ($5,209), and 10 schools received provincial subsidies amounting to 9,600 francs ($1,853). The 11 schools above mentioned had other receipts amounting to 26,932 francs ($5,198).

This class of schools has been considered at some length because of its increasing importance. While there were but 12 trade schools in 1896, the number had increased to 36 in 1901. The number of students (including those in the apprenticeship shops of the industrial school of Tournay) was 833 in 1896, while in 1901 it was 2,819. This shows a gain during the 6-year period of 191.7 per cent in the number of schools and 238.4 per cent in the attendance. From this showing we may safely infer that the trade school is gaining favor in Belgium.

Following is a list of 36 trade schools in Belgium in 1901, arranged by trades and localities: Barbers', Antwerp, Brussels; bookbinding

and gilding, Brussels; carpentry and joining, Nivelles; firearms making, Liege, Wandre; fishing, Blankenberghe, Nieuport, Ostend (2); jewelry work and chasing, Antwerp, Brussels; metal and wood working, Ghent, Louvain; painting (house), etc., Brussels, Ghent, Liege; plumbing, Brussels; printing, Brussels; tailoring, Brussels, Liege; trade drawing, Anthisnes, Brée, Mierelbeke; upholstering, draping, etc., Brussels, Ghent; watchmaking, fine mechanical work, and electricity, Brussels; weaving, spinning, dyeing, and finishing, Courtrai, Renaix; wood and marble work, Ath; trade not specified, Ghent, Liege, Manage, Namur, Oostacker, Josse-Ten-Noode.

The school of carpentry and joining at Nivelles, one fishing school at Ostend, the metal and wood working school and the painters' school at Ghent, and the schools for weaving, spinning, etc., at Courtrai and Renaix are communal schools. The ownership of 7 schools is not reported. The remaining 23 schools reported in 1901 are private institutions.

The following table derived from the report of 1897 shows for each of the 12 schools then in existence the year when the school was established, the receipts for the year, the duration of studies, and the number of teachers, students, and graduates during 1895–96:

STATISTICS OF TRADE SCHOOLS FOR MALES, 1895–96.

School.	Year established.	Subsidies granted in 1895–96 by the—			Other receipts.	Total receipts.	Length of course (years).	Number of teachers.	Number of students.	Graduates during year.
		State.	Province.	Commune						
Trade school of fishing, Blankenberghe	1890	$155	$96	$96	$17	$364	3	5	90	2
Trade school of art applied to chasing and jewelry working, Brussels	1894	270	39	289	158	756	4	3	60	.....
National school of watchmaking, fine mechanical work, and electricity, Brussels	1890	965	270	290	1,400	2,925	4	5	34	5
Trade school of tailoring, Brussels	1880	494	193	579	1,159	2,425	4	5	27	5
Trade school of upholstering, draping, trimming, furnishing, etc., Brussels	1894	386	77	116	186	765	3	5	40	.....
Trade school of printing, Brussels	1888	525	174	376	201	1,276	5	7	76	2
H. Nicaise trade school of metal and woodworking, Ghent	1887	1,448	482	3,173	448	5,551	3	9	84	11
Trade school of tailoring, Liege	1888	386	290	290	449	1,415	3	4	40	9
Trade school of firearms making, Liege	1896	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
St. Peters trade school, Louvain	1889	409	.....	.....	614	1,023	(b)	8	152	7
Trade school of fishing, Nieuport	1893	108	77	.....	87	272	2	3	19	.....
Communal trade school of fishing, Ostend	1888	349	155	.....	479	983	3	6	96	9
Apprenticeship shops of industrial school, Tournay	1860	(c)	(c)	(c)	(c)	(c)	5	3	115	11
Total	.....	5,495	1,853	5,209	5,198	17,755	.....	63	833	61

a School had not been in operation long enough to furnish data.
b Varies according to trade.
c Included in industrial school.

SUPERIOR TRADE AND TECHNICAL SCHOOLS.

This class contains a few schools that have been organized for the purpose of giving a higher trade or technical education to those who expect to hold positions of responsibility in industrial enterprises. These schools train their pupils to be foremen, overseers, superintendents, or other highly skilled salaried officials, such as metallurgists, civil engineers, mining engineers, brewing engineers, etc.

There are 13 superior trade schools now receiving Government subsidies, but 7 of them are higher commercial or commercial and consular schools, and as such have no place in this report. Of the 6 remaining schools, 1 was not organized until 1901, which leaves but 5 for which information is at hand. Their names and locations are: Provincial School of Industry and Mines, Mons; Superior Textile School, Verviers; Superior Institute of Brewing, Ghent; Technical School of Brewing, Ghent; Superior School of Brewing, La Louviere; School of Arts and Trades, Pierard-lez-Virton (established in 1901). The first of these is a provincial school, the second a communal school, the third, fourth, and fifth are private schools, and the ownership of the sixth is not specified.

The school at Mons is too highly technical in character to be considered in this report. The courses have been of four years' duration, but for the higher diplomas five years will be required after 1902. Graduates receive the diploma of "engineer" in the following specialties: Exploitation of mines, metallurgy, industrial chemistry, mechanics, railway construction, building construction, and electricity. At the close of the sixty-second year of the school's existence, in 1901, 775 such diplomas had been granted. The surviving graduates were shown for the greater part to be engaged as follows: Civil engineers, mining engineers, directors or owners of industrial establishments, directors of works, civil engineers engaged in railroad and other similar work, chief engineers in industrial enterprises, engineers in or directors and owners of chemical works, metallurgists in steel and iron works, electrical engineers, etc.

Of the four remaining schools, the textile school at Verviers and the Superior Institute of Brewing at Ghent are the most important. In these two schools the character of the instruction is much superior to that required of ordinary workmen, or even of mere foremen, but although they confer the degree of engineer, they can hardly be said to prepare students for professional careers in the same sense as does the school at Mons. They may be regarded as higher trade schools, teaching as they do the theory and manipulations required in the particular industries of brewing and textiles. The brewing school more especially belongs to the class of schools with which this report is con-

cerned, for, although its complete programme of studies is arranged with a view of preparing students for salaried positions, or as managers, manufacturers, etc., in the brewing and distilling industries, it also allows students to prepare for the inferior positions in these industries, and even has a free course for ordinary foremen and employees.

The first five superior schools previously named receive State subsidies. The school of industry and mines, the textile school, and the institute of brewing at Ghent also receive subsidies from the province and from the commune.

The following table shows the number of teachers, the number of students, and the number of graduates for each school for the school years 1884–85 to 1895–96:

TEACHERS, STUDENTS, AND GRADUATES OF SUPERIOR TRADE AND TECHNICAL SCHOOLS, 1884-85 TO 1895-96.

Year.	School of Industry and Mines, Mons.			Superior Textile School, Verviers.			Superior Institute of Brewing, Ghent.			Technical School of Brewing, Ghent.			Superior School of Brewing, La Louviere.		
	T'chers.	Students.	Graduates.	T'chers.	Students.	Graduates.	T'chers.	Students.	Graduates.	T'chers.	Students.	Graduates.	T'chers.	Students.	Graduates.
1884–85.	13	71	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1885–86.	13	58	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1886–87.	15	61	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1887–88.	15	67	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1888–89.	15	69	7	.....	.....	.....	8	55	12	.....	.....	.....	.....	.....	.....
1889–90.	15	91	15	.....	.....	.....	9	70	5	.....	.....	.....	.....	.....	.....
1890–91.	15	104	18	.....	.....	.....	11	65	15	.....	.....	.....	.....	.....	.....
1891–92.	15	145	18	.....	.....	.....	11	61	15	.....	.....	.....	.....	.....	.....
1892–93.	16	176	17	.....	.....	.....	11	59	13	.....	.....	.....	.....	.....	.....
1893–94.	16	183	20	.....	.....	.....	11	73	20	.....	.....	.....	.....	.....	.....
1894–95.	17	193	28	8	11	.....	11	71	26	.....	.....	.....	.....	.....	.....
1895–96.	17	215	20	9	17	.....	12	57	26	6	19	6	6	17	6

SAINT LUKE TRADE SCHOOLS.

The group known as "Saint Luke" schools forms an interesting special class of institutions for the trade education of boys. In 1862 a modest course of drawing was opened at Ghent under the auspices of the Society of Saint Vincent de Paul. This institution was enlarged by the addition of other courses relating chiefly to the building and furniture trades, and the group of courses was given the name Saint Luke School (*École Saint-Luc*). Its direction was intrusted to the brothers of the Christian schools. The attendance at the school grew steadily, and at the time of the last report a trade education was being given to more than 600 students.

The success of the Ghent school led to the creation of similar schools in other cities, and wherever established they have proved successful and the Government has granted financial and moral aid. The purpose of these schools is stated to be "to aid young men, and in particular the sons of artisans, to acquire the theoretical and practical

knowledge necessary for them to gain honorable positions in the various trades connected with the building industry and decoration, as architecture, public works, contracting, carpentry, joinery, cabinet-making, wood and stone carving, wrought iron and locksmith working, painting of all kinds, embroidering, engraving, jewelry making," etc. In carrying out this purpose great emphasis is laid upon the application of art to industry. The ideal is to form workmen taking a pride in and loving their trades and capable of producing the beautiful workmanship that finds expression in the old city halls, guild houses, cathedrals, etc., of the Flemish cities.

The rapid progress of the Saint Luke schools, though due in part to the devotion of their organizers and managers, is also ascribed largely to the rational and practical methods of instruction which are at all times closely observed. In accordance with the special method followed in the schools, the care of developing the merely manual dexterity of the young workman is in most cases left to his employer, but the school assumes the task of perfecting his trade education by teaching him drawing, supplemented by special theoretical courses. The whole endeavor is to develop an esthetic taste and creative faculty in the pupil. To facilitate the realization of this programme, the instruction includes not only general class exercises, useful for all the students, but each student receives separate attention and instruction according to his aptitude, talents, and degree of advancement. The student begins by learning to draw the simplest things from the usual models. From simple drawing he is led gradually to the higher grades of work, in which the instruction is augmented by other auxiliary courses. The student then advances into the special form of art which is applicable to his trade. Here the architect, mason, wrought-iron worker, or carpenter applies himself to the interpretation, the analysis, and later to the composition of designs applicable to his work, and always after the purest art models. Here the decorator, the upholsterer, and the furniture maker study all that pertains to the art of decoration and furnishing. In the same manner the binder, the jeweler, the goldsmith, and the metal chaser absorb ideas which are valuable to them by studying in a practical manner the difficulties of execution which exist in their trades. The faculty of originating themes and applying them in decoration is developed during the later years of study.

At present there are five Saint Luke schools. The one at Ghent dates from 1862, since which year there have been created one at Liege, in 1880; one at Schaerbeek (Brussels), in 1884; one at Tournay, in 1878; and one at Molanbeek, in 1900. The principal facts for the first four schools will be mentioned briefly, a description of the individual schools being presented in another place.

The duration of studies, including the full course in drawing and composition, is generally seven years. The school at Liege, however, has a preparatory course of two years in addition to the regular courses, making the complete duration of study nine years. The school term opens October 1 in all schools and closes at various dates from July 31 to August 10. Each school has an evening session of two hours. Three schools have Sunday sessions which are intended for students who can not attend the evening courses. These Sunday sessions are of two and one-fourth, two and one-half, and two and three-fourths hours' duration, according to the school in which they are given. In the Liege school there is, for another class of students, a regular day session of two and one-half hours' duration in addition to the Sunday and evening sessions.

While these institutions are called trade schools, at least three of them are more properly schools of art applied to industry. These are the Ghent, the Liege, and the Schaerbeek schools. They have no workshops of their own, but in connection with them there are a number of shops owned or directed by graduates of the school in which students learn the manual operations. The Tournay school, however, has a different organization. In that school a number of workshops have been established in which the students serve an apprenticeship, working seven and three-fourths to nine and one-fourth hours per day according to season. This arrangement is exactly similar to that obtaining in some of the regular trade schools, such as the tailoring schools.

No tuition fee is charged, but in some schools the student is charged a small entrance fee or is required to help share the expenses for lighting, fuel, material, etc. These schools received subsidies from the state in 1895–96 to the amount of 20,120 francs ($3,883). One school (Ghent) received a provincial subsidy of 1,500 francs ($289). The various other receipts amounted to 37,199 francs ($7,180) for the four schools, bringing the total of the receipts up to 58,819 francs ($11,352).

The following table shows for each of the four schools the year when the school was created, the total receipts for 1895–96, the duration of studies, and the number of teachers and students:

RECEIPTS, TEACHERS, AND STUDENTS, SAINT LUKE TRADE SCHOOLS, 1895–96.

Locality.	Year established.	Subsidies granted in 1895–96 by the—		Other receipts.	Total receipts.	Length of course (years).	Number of teachers.	Number of students.
		State.	Province.					
Ghent	1862	$1,274	$289	$1,332	$2,895	7	10	620
Liege	1880	521	.....	1,216	1,737	a7	5	280
Schaerbeek	1884	1,335	.....	3,273	4,608	7	15	450
Tournay	1878	753	.....	1,359	2,112	7	9	194
Total	.....	3,883	289	7,180	11,352	.....	39	1,544

a Including preparatory course, 9 years.

The total number of students attending these schools in 1895–96 was 1,544. During the same year 39 teachers were employed. On December 1, 1901, the five schools then in operation employed 58 teachers and the attendance had increased to 1,817.

APPRENTICESHIP SHOPS FOR MALES.

This class contains a number of institutions the purpose of which is to allow boys to serve a regular apprenticeship under better conditions than obtain in the private workshops. The existence of special workshops for training apprentices is one of the characteristic features of the system of trade education in Belgium. There are apprenticeship shops for teaching various trades attached to the trade schools proper and to one industrial school (Tournay), but such shops form part of the school organization and can not be identified with the class under discussion. This class relates entirely to two specific industries, hence we have two subdivisions, viz: Apprenticeship shops for stonecutting and apprenticeship shops for weaving. The apprenticeship shops for weaving were the first to make their appearance, their origin being due principally to special causes which are fully explained in the general description of these shops. The apprenticeship shops for stonecutting are due to special needs, but of a wholly different nature from those primarily governing the establishment of the weaving shops.

Apprenticeship shops, like the various classes of schools, are placed under the direction of administrative commissions, in which the State, province, and commune usually have equal representation. These shops are much like trade schools, but nearly all the general studies carried in trade schools are lacking, and much less time is devoted to theory. They can be more readily considered by treating each of the subdivisions separately.

APPRENTICESHIP SHOPS FOR STONECUTTING.

The first shop for stonecutting was established by the commune of Ecaussines-d'Enghien in 1873, on the solicitation of certain master quarrymen. The object was to furnish good workmen, the supply of whom was becoming scarce. A workshop was organized on property belonging to the commune several miles from the quarries, from which fact considerable inconvenience resulted. This institution had a more or less precarious existence, and was superseded in 1890 by a different organization, in accordance with which a system of shops was established at private quarries, all shops in the commune, however, remaining under the same administrative commission. Since that date there has been a steady growth in the number of shops. When the report of 1897 was issued there were 11 shops in this commune. The cost was inconsiderable, the total budget for 1896 being 12,725 francs

($2,456), of which sum the State paid 5,110 francs ($986), the province 2,000 francs ($386), and the commune 1,500 francs ($290), while sums aggregating 4,115 francs ($794) were received from the master quarrymen and from other sources.

Other communes, in which stone quarrying and cutting operations are carried on, have established apprenticeship shops since 1896. In 1901 there were 22 such shops in Belgium, located at Aywaille, Ecaussines-d'Enghien, Ecaussines-Lalaing, and Sprimont. Fourteen of these shops are located in the two Ecaussines, and, as they are under one supervision and constitute the only apprenticeship shops for stone-cutting for which there is any information, they have been treated as a single institution and are fully described in connection with the separate schools.

APPRENTICESHIP SHOPS FOR WEAVING.

The creation of apprenticeship shops for weaving is intimately related to the transformation which the textile industries in general, and the linen industry in particular, underwent at the close of the eighteenth and the beginning of the nineteenth centuries. At that period the linen industry of Flanders was entirely carried on by artisans working in their own homes with hand tools, and was in a most prosperous condition. With the introduction of machinery the whole condition of the trade underwent a virtual revolution. The peasants and workmen of Belgium were unable immediately to adjust themselves to the changed conditions, and a serious crisis resulted and suffering was widespread. To render assistance to the people the communal council of Ghent founded, in 1817, a workshop for the preparation and manufacture of linen, the manufacture of woolen goods, and the carrying on of lace making, embroidery, dressmaking, shoemaking, and joinery. The sole idea of this undertaking was a charitable one—that of giving work to the unemployed. It was destined, however, as will be seen, to be the initial move in the creation of establishments having as their essential purpose the training of skilled workmen.

The example of Ghent was not followed until 1832, when the next shop was opened by the commune of Petegemlez-Audenarde. The depression in the linen industry becoming more and more intense, the central Government, on the request of the National Association for the Advancement of the Old Linen Industry, appointed a commission to investigate the causes of the depression and suggest what measures should be taken to improve existing conditions. Upon the recommendation of this commission, the Government appointed special industrial committees to act in conjunction with the local authorities for the improvement of the industry. Among the specific ways in which they were directed to take action was the creation of schools of trade

apprenticeship at the expense of the public authorities. At the same time the administration established, as an experiment, several shops in which the new methods of weaving and the improvements introduced in the industry were taught in a practical manner. The communes of Ghent and Petegemlez-Audenarde, as has been seen, already possessed shops which were being utilized for this purpose. These were merely local enterprises. In 1841, however, the provinces and the State began the policy of granting subsidies in aid of such work. A year or two later the State authorities took advantage of the law of September 23, 1842, on primary education, to devote a part of the appropriation made for public education to the extension of a system of schools established under the name of "charity and apprenticeship workshops" (*ateliers de charité et d'apprentissage*), and the local governments and manufacturers were urged to create such shops by the promise of subsidies.

These shops, which more and more became pure apprenticeship workshops, were definitely organized by the royal order of January 26, 1847. In 1849 a special system of inspection was organized. Article 1 of the order of 1847 thus defines the purpose of these shops: "Independently of the factory schools or apprenticeship workshops organized in connection with the primary schools in virtue of article 25 of the law of September 23, 1842, there will be established, for the benefit of young persons of more advanced age and adults, apprenticeship or improvement workshops having for their function the training of good workmen. * * * In these model shops instruction will be given, according to local needs and circumstances, in the making of established products or new textiles, and particularly in the operation of looms which can be run by individual workmen using inexpensive tools."

In 1860 an investigation of these shops was made, and the benefits resulting from them were found to be such that public opinion was almost unanimous that they, though created for a special purpose, should be made permanent institutions, as effective means for the trade training of the people.

Regarding the results accomplished by these shops, the report on technical education made in 1884 says: "The reports presented on a number of occasions by the Government to the legislature show that the result of the apprenticeship workshops has been the improvement of linen spinning and weaving, the replacing of work in linen in part by other branches of textile work; * * * in a word, the shops have contributed greatly to the introduction of new industries and improved methods. They have also improved the conditions of labor in advancing the training of apprentices, and have assisted in raising the rate of wages and in the development of a spirit of enterprise."

At the end of the apprenticeship year 1895 a total of 26,655 workmen had been educated in these shops.

The number of shops at present is not nearly so large as in former years. Statistics showing the situation at the end of each of the periods for which the Government reports were issued are of interest. In 1879 there were 59 shops. During the period 1879 to 1884, 14 shops were closed, as it was found that results in them were not sufficient to warrant their maintenance. Thus there remained in 1884 45 shops, in which 919 apprentices were being trained. The last report on industrial education, covering the period 1885 to 1896, inclusive, shows that during the period a considerable number of the shops existing in 1884 were closed, while additional ones were created in other places, there remaining at the end of the period 42 shops in operation. Finally, the Revue du Travail shows a net reduction of 3 in the number of shops during 1897, of 2 in 1898, and 1 in 1901, which left in the latter year but 36 shops, in which 702 apprentices were being trained. Some of these shops are really weaving schools. In fact, these institutions have outlived their former purpose of training ordinary workmen in the use of new machinery, the manufacture of new textiles, etc., and at present the tendency is toward an improvement in the character of the remaining shops and their gradual evolution into trade schools by devoting more time than formerly to theory and adding instruction in drawing, mechanics, etc. In regard to this tendency, the inspector of apprenticeship shops of East Flanders makes the following statement concerning changes introduced in the organization of the shops of that province during the period 1885 to 1896:

In order to maintain these establishments on a level with the standard of manufactures, the minister has expressed by circular of February 10, 1890, the desire that the more important shops be transformed into trade schools for weaving, having a simple and practical organization. The communal authorities of Calcken and Waesmunster have acted in accord with the inspector to carry out this wish. To trade instruction in the theory and practice of weaving have been added courses in drawing and mechanics, which are attended not only by the pupils proper but other persons of the locality. * * * As a result, from 1885 to 1896 2 shops, Waesmunster and Calcken, have been transformed into trade schools for weaving; 4 shops, Baelegem,[a] Olsene, Ruyen, and Synghem, have been transferred to larger buildings; 3 shops, Calcken, Waesmunster, and Cruyshautem, have been enlarged by the annexation of another room, and a trade school for weaving has been created. With improved appliances the schools are able to turn out well-prepared workmen, and employers, satisfied that good work is performed therein, are willing to trust their raw materials to the shops. These institutions continue to render great service to the

[a] Suppressed since the report was issued.

working class. In effect, the young men learn the trade while earning a proper wage; they perfect themselves in the manufacture of all the different kinds of textiles, and are thus able afterwards to secure remunerative work.

The foregoing statements relative to the situation in East Flanders apply with equal force to West Flanders, in which province the same tendency in regard to transforming apprenticeship shops into weaving schools is noticed. To what extent the change has actually been made may be seen in the following list of the location of the 37 shops and schools in existence in 1900, furnished by the ministry of industry and labor:

APPRENTICESHIP SHOPS AND TRADE SCHOOLS FOR WEAVING.

East Flanders.

Apprenticeship shops: Cruyshautem, Eenaeme, Olsene, Oordeghem, Ruyen, Sinay, and Synghem; total, 7.

Trade schools: Calcken, Oostacker (Meulestede), and Waesmunster; total, 3.

West Flanders.

Apprenticeship shops: Aerseele, Aertrycke (2), Ardoye, Deerlyk, Lendelide, Lichtervelde, Meulebeke, Oostnieuwkerke, Paschendaele, Pitthem, Ruddervoorde, Ruysselede (2), Thielt, Waereghem (2), Westroosebeke, and Wyngene; total, 19.

Trade schools: Coolscamp, Denterghem, Moorslede, Oost-Roosebeke, Rumbeke, Staeden, Thourout, Wacken; total, 8.

Because of the manner in which the information is presented in the reports of the Belgian Government, the apprenticeship shops and schools of weaving have been described collectively and at length in this place. No description of individual institutions, especially of the schools, is possible from the material at hand. The last report places them all under the head of "Apprenticeship shops."

A few hours each week are devoted to primary instruction in the shops. In the schools the teaching of drawing and mechanics occupies one or two hours a week. Theory is generally taught along with the practical work. The total number of workmen prepared during the year 1895 was 293.

Subsidies received from the State in 1896 amounted to 34,215 francs ($6,603); those from the provinces to 10,195 francs ($1,968), and those from communes to 16,578 francs ($3,200). Other receipts amounted to 5,611 francs ($1,083), thus bringing the total receipts up to 66,599 francs ($12,854).

The following table presents some of the more important facts in relation to each of the 42 shops or schools existing in 1895, the latest year for which such information is obtainable:

NUMBER, DAILY EARNINGS, AND DEGREE OF EDUCATION OF APPRENTICES, AND KIND OF ARTICLES MADE IN APPRENTICESHIP SHOPS AND TRADE SCHOOLS FOR WEAVING, 1895.

Location of school or shop.	Articles made or work done.	Number of apprentices.	Average daily earnings.	Degree of education of apprentice.			
				Able to read, write, and calculate.	Able to read and write.	Able to read.	Illiterate.
WEST FLANDERS.							
Aerseele	Linen cloth, tow linen, towels, napkins, ticking.	20	$0.125	13	4	3	.....
Aertrycke	Linen cloth, linen squares, ducking, towels, napkins, molletons.	20	.145	7	10	2	1
Do	Linen cloth, towels, ducking	14	.154	4	7	3	.....
Ardoye	Linen cloth and tow linen	18	.087	12	5	.....	1
Clercken	Linen cloth, handkerchiefs, beaverteen.	7	.125	3	2	2	.....
Coolscamp	Linen cloth, cotton-linen, towels, napkins, beaverteen.	10	.097	2	4	3	1
Courtrai	Linen cloth, ducking	3	.174	3	.....	.....	.....
Denterghem	Ordinary and figured towels, napkins (jacquard), damask.	18	.145	8	7	3	.....
Deerlyk	Window curtains, ducking, upholstering material, articles for exportation.	30	.290	20	8	1	1
Hooglede	Linen cloth, towels, dimity, beaverteen, damask, printaniere.	15	.212	6	9	.....	.....
Lichtervelde	Linen cloth, linen squares, ducking, window curtains, napkins.	7	.154	2	2	2	1
Lendelide	Linen cloth and tow linen, handkerchiefs, ticking.	18	.087	10	3	3	2
Meulebeke	Linen cloth, tow linen, figured towels, ticking.	18	.087	18	.....	.....	.....
Moorslede	Linen cloth, ticking, ordinary and figured towels, napkins.	26	.193	7	10	6	3
Oost-Roosebeke.	Linen cloth, towels, ticking, cottonette, damask.	.....	.....	.....	.....	.....	.....
Oostnieuwkerke.	Linen cloth, linen squares, cottonette, molletons.	15	.145	11	4	.....	.....
Pitthem	Window curtains, ticking, napkins	15	.154	9	2	3	1
Paschendaele	Linen cloth, towels, cotton-linen, molleton, cotton velvet, beaverteen.	15	.183	8	2	2	3
Rumbeke	Linen cloth, cotton velvet, cotton-linen, beaverteen, figured towels, napkins.	23	.145	15	4	2	2
Ruysselede	Linen cloth, towels, table spreads, napkins.	22	.174	10	6	4	2
Do	Linen cloth, tow linen, towels	18	.154	11	2	3	2
Ruddervoorde	Linen cloth, linen squares, towels, upholstering material.	27	.193	14	6	3	4
Staeden	Linen cloth, towels, molleton, napkins	10	.097	3	5	1	1
Swevezeele	Linen cloth, towels, napkins	15	.145	7	4	2	2
Thourout	Linen cloth, dimity, beaverteen, window curtains, napkins, upholstering material.	17	.241	10	3	4	.....
Thielt	Figured towels, tablecloths, napkins, upholstering material.	59	.290	17	19	13	10
Waereghem	Linen cloth, ticking, cottonade, articles for exportation.	26	.174	8	13	2	3
Do	Window curtains, linen cloth, towels.	18	.145	4	9	3	2
Wacken	Linen cloth, cottonade, ticking	13	.145	4	5	2	2
Westroosebeke	Linen cloth, linen squares, molleton, beaverteen.	18	.116	12	3	.....	3
Wyngene	Linen cloth	7	.116	5	.....	.....	2
EAST FLANDERS.							
Baelegem	Mixed cloths, striped and checked, ticking for shirts, dress materials, etc.	19	$0.097 to .338	14	2	.....	3
Calcken	Linen towels and napkins, linen and cotton mixed, ticking for shirts, flannels, etc.	34	.048 to .386	17	14	1	2
Cruyshautem	Cottonade, ticking for shirts, mixed linen, dress goods, etc.	15	.048 to .193	15	.....	.....	.....
Eenaeme	Linen cloth, towels, ticking for shirts, etc.	16	.048 to .193	9	5	2	.....

NUMBER, DAILY EARNINGS, AND DEGREE OF EDUCATION OF APPRENTICES, AND KIND OF ARTICLES MADE IN APPRENTICESHIP SHOPS AND TRADE SCHOOLS FOR WEAVING, 1895—Concluded.

Location of school or shop.	Articles made or work done.	Number of apprentices.	Average daily earnings.	Degree of education of apprentice.			
				Able to read, write, and calculate.	Able to read and write.	Able to read.	Illiterate.
EAST FLANDERS—concl'd.							
Olsene	Linen cloth, towels, ticking for shirts.	6	.125	4	2	.....	.....
Oordeghem	Linen cloth, towels, napkins, tablecloths, ticking for shirts, etc.	32	.048 to .338	22	.....	2	8
Oostacker	Mixed linen cloths, towels, cottonade, flannel and ticking for shirts, etc.	24	.097 to .193	22	.....	2	.....
Ruyen	Linen and mixed linen cloths, upholstering cords, ticking for shirts, etc.	18	.048 to .241	16	.....	.....	2
Sinay	Cottonade, ticking for shirts, woolen and half woolen goods, etc.	11	.261	5	4	2	.....
Synghem	Cottonade, ticking for shirts, dress materials in cotton, half wool, etc.	23	.241 to .290	11	10	2	.....
Waesmunster	Cottonade, dress materials in cotton, half wool, and pure wool, etc.	20	.058 to .434	20	.....	.....	.....
Total		760		418	195	83	64

TRADE COURSES FOR MALES.

This class comprises a few cases where courses are given in drawing, theory, and practical exercises relating to various trades. They are for the benefit, more particularly, of workingmen engaged in the trades, and but one or two sessions a week are held. In 1896 there were but three real trade courses, although the report mentions a few more in which commercial instruction only is given. A number of trade courses have been organized in connection with some of the schools since that date. Attendance at the courses in operation in 1896 was free. A short description of them will be found in another place. This class is not very important.

The following list shows the trade courses for males existing in 1900: Basket making, Tamise; industrial drawing, Montegnée; mechanics and electricity, Borsbeke; shoemaking, Louvain; shoemaking and tailoring, Antwerp; tanning, Liege; trade drawing, Herve and Waterloo; trade painting, Audenarde; weaving, Saint-Nicolas and Zele; weaving theoretical course for mill foremen and employees, Rumbeke, general apprenticeship, continuation, etc., courses, Namur.

Of the above-mentioned courses those at Herve, Montegnée, Rumbeke, and Waterloo are communal, while the remainder are private institutions.

There has been an enormous development in the system of trade and technical education in Belgium within recent years. In order to show the extent of this development the following two tables are presented, one relating to the institutions for females and the other to those for males. In each table are shown under each class the number of institutions, teachers, students, and certificates or diplomas delivered during each year of the period 1884–85 to 1901. The data for the years 1884–85 to 1895–96 are derived from the Government report of 1897, and those for the following years from the Revue du Travail, an official publication of the ministry of industry and labor. Aside from showing the rapid development of the system as a whole by far the most noticeable features are the great increases to be observed within the last few years in the number of trade schools and housekeeping schools and classes for females, and of industrial and trade schools for males. The gradual and almost regular increases in attendance in most classes of institutions is another interesting feature. These facts have been fully discussed in connection with the general description of each class and need no further mention in this place.

NUMBER OF INSTITUTIONS, TEACHERS, STUDENTS, AND CERTIFICATES OR DIPLOMAS DELIVERED, FOR EACH YEAR, 1884–85 TO 1901, IN EACH CLASS OF INSTITUTIONS FOR FEMALES.

Year.	Trade schools, including—											
	Trade schools proper.				Trade and housekeeping schools.				Housekeeping and trade schools.			
	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.
1884–85	3	66	896	43	.....	.....	.....	.....	.....	.....	.....	.....
1885–86	3	65	866	54	.....	.....	.....	.....	.....	.....	.....	.....
1886–87	5	77	1,175	64	.....	.....	.....	.....	.....	.....	.....	.....
1887–88	5	85	1,304	83	.....	.....	.....	.....	1	5	(a)	.....
1888–89	5	86	1,235	86	1	4	28	.....	1	5	100	.....
1889–90	7	93	1,320	95	2	7	88	.....	2	9	131	1
1890–91	7	98	1,335	106	3	17	87	.....	2	9	165	1
1891–92	9	109	1,416	94	4	29	286	.....	2	10	168	3
1892–93	9	117	1,628	102	4	31	354	5	2	10	168	4
1893–94	10	126	1,686	120	6	50	477	13	3	11	209	2
1894–95	10	131	1,739	141	6	55	487	20	3	11	230	6
1895–96	14	157	2,022	133	6	58	467	25	3	13	259	4
1897 b	c 30	c 294	c2, 947	c 157	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
1898 b	c 37	c 362	c3, 846	c 292	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
1899 b	c 45	c 425	c4, 204	c 342	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
1900 b	c 48	c 460	c4, 394	c 338	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
1901 b	c 46	c 482	c4, 567	c 384	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)

a Not reported.
b For year ending December 31; these data are from the Revue du Travail.
c Including trade and housekeeping and housekeeping and trade schools.
d Included in trade schools proper.

NUMBER OF INSTITUTIONS, TEACHERS, STUDENTS, AND CERTIFICATES OR DIPLOMAS DELIVERED, FOR EACH YEAR, 1884-85 TO 1901, IN EACH CLASS OF INSTITUTIONS FOR FEMALES—Concluded.

Year.	Housekeeping schools and housekeeping classes.				Trade courses.				Apprenticeship shops.			
	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.
1884-85	2	(a)	90	(a)	.....	.....	.....	.....	1	2	54	.....
1885-86	2	(a)	90	(a)	.....	.....	.....	.....	1	2	52	.....
1886-87	4	(a)	135	(a)	2	9	62	.....	1	2	54	.....
1887-88	9	(a)	540	(a)	2	10	90	3	1	2	56	.....
1888-89	17	(a)	1,052	(a)	2	10	90	8	1	2	62	.....
1889-90	35	(a)	1,899	(a)	2	11	103	19	1	2	84	.....
1890-91	89	(a)	4,877	(a)	2	11	91	10	1	2	82	.....
1891-92	134	(a)	6,561	(a)	3	15	113	18	1	2	73	.....
1892-93	158	(a)	7,893	(a)	3	17	145	14	1	2	78	.....
1893-94	181	(a)	8,273	(a)	3	20	181	17	2	7	124	.....
1894-95	212	(a)	9,538	(a)	3	25	185	17	2	7	128	.....
1895-96	225	(a)	9,539	(a)	3	14	156	17	2	7	133	.....
1897 b	239	506	9,368	(a)	3	19	114	20	2	5	142	43
1898 b	245	534	9,041	434	3	18	124	16	2	6	122	32
1899 b	269	624	9,505	517	3	22	121	20	4	16	217	33
1900 b	278	625	9,778	630	3	19	142	16	4	14	208	31
1901 b	277	636	9,791	823	3	23	132	18	4	12	216	11

a Not reported.
b For year ending December 31; these data are from the Revue de Travail.

NUMBER OF INSTITUTIONS, TEACHERS, STUDENTS, AND CERTIFICATES OR DIPLOMAS DELIVERED FOR EACH YEAR, 1884-85 TO 1901, IN EACH CLASS OF INSTITUTIONS FOR MALES.

Year.	Industrial schools.				Trade schools.				Superior trade and commercial, etc., schools.			
	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Institutions.	Teachers.	Students.	Certificates or diplomas delivered.
1884-85	32	328	9,171	296	1	3	83	10	2	29	210	45
1885-86	32	329	9,478	368	2	3	87	18	2	29	195	52
1886-87	33	329	10,160	359	2	7	90	7	2	31	205	33
1887-88	33	334	10,330	414	3	12	150	10	2	31	209	36
1888-89	34	362	11,284	475	5	18	315	13	3	39	308	60
1889-90	36	387	11,039	509	7	34	483	28	3	40	302	45
1890-91	36	388	12,407	557	9	45	613	32	3	42	366	76
1891-92	36	408	12,913	631	9	52	721	56	3	42	431	83
1892-93	36	425	12,850	659	9	53	696	50	3	43	463	85
1893-94	38	439	12,817	712	10	54	661	46	3	43	485	81
1894-95	38	448	12,223	728	11	56	750	54	4	52	494	107
1895-96	40	466	13,015	684	12	63	833	61	6	66	555	125
1897 a	45	481	13,006	887	18	109	1,151	37	6	72	611	144
1898 a	57	622	17,120	971	22	120	1,396	68	7	85	686	146
1899 a	60	679	17,932	1,177	24	138	1,580	72	9	131	783	183
1900 a	65	741	18,868	1,284	31	187	2,075	114	11	167	974	233
1901 a	70	817	20,733	1,382	35	247	2,819	146	13	223	1,048	297

a Not reported.

NUMBER OF INSTITUTIONS, TEACHERS, STUDENTS, AND CERTIFICATES OR DIPLOMAS DELIVERED FOR EACH YEAR, 1884–85 TO 1901, IN EACH CLASS OF INSTITUTIONS FOR MALES—Concluded.

Year.	Apprenticeship shops for— Stone cutting. Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Weaving. Institutions.	Teachers.	Students.	Certificates or diplomas delivered.
1884–85					45	45	865	431
1885–86					45	45	874	370
1886–87					45	45	890	358
1887–88					43	43	984	323
1888–89					41	41	852	286
1889–90					40	40	996	315
1890–91	5	5	(a)		41	41	938	312
1891–92	6	6	109		41	41	929	305
1892–93	7	7	148	8	41	41	922	288
1893–94	10	10	218	26	42	42	893	294
1894–95	11	11	254	20	42	42	835	302
1895–96	11	11	265	26	42	42	760	283
1897 b	11	12	274	47	39	52	862	(a)
1898 b	14	15	407	33	37	53	696	155
1899 b	14	16	378	16	37	78	620	106
1900 b	20	24	532	23	37	79	567	106
1901 b	22	30	605	37	36	79	702	33

Year.	Saint Luke Trade Schools. Institutions.	Teachers.	Students.	Certificates or diplomas delivered.	Trade courses. Institutions.	Teachers.	Students.	Certificates or diplomas delivered.
1884–85	2	8	225		1	1	30	
1885–86	2	8	240		1	1	30	5
1886–87	2	9	262		1	1	30	
1887–88	4	30	967		1	1	30	
1888–89	4	32	1,021		1	1	30	
1889–90	4	32	1,178		1	1	30	
1890–91	4	38	1,245		1	1	30	
1891–92	4	39	1,351		1	1	30	
1892–93	4	39	1,372		1	1	30	
1893–94	4	39	1,397		2	3	52	
1894–95	4	39	1,415		2	3	60	
1895–96	4	39	1,544		2	3	55	
1897 b	4	42	1,661		4	13	220	6
1898 b	4	47	1,607		5	22	280	
1899 b	5	50	1,644		10	38	430	
1900 b	5	52	1,766	26	13	40	505	20
1901 b	5	58	1,817	7	15	52	647	20

a Not reported.
b For year ending December 31; these data are from the Revue du Travail.

The following table, compiled from data contained in the report for 1897, shows for the school year 1895–96 the total receipts of each class of institutions considered in this report, together with the amount contributed by the State, the provinces, and the communes. It will be seen that the total receipts amounted to 1,567,319 francs ($302,493), of which 1,204,567 francs ($232,482), or 76.9 per cent, were received in subsidies. Of the subsidies received, the State contributed 543,460 francs ($104,888), the provinces 194,358 francs ($37,511), and the communes 466,749 francs ($90,083). Other receipts, consisting of tuition and entrance fees, gifts from individuals, etc., amounted to 362,752 francs ($70,011).

SUBSIDIES GRANTED BY THE STATE, PROVINCES, AND COMMUNES, AND TOTAL RECEIPTS FOR EACH CLASS OF INSTITUTIONS, 1895–96.

Classes of institutions.	Subsidies granted by—			Total subsidies.	Other receipts.	Total receipts.
	State.	Provinces.	Communes.			
For girls:						
Trade schools	$13,008	$3,563	$19,266	$40,837	$25,647	$66,484
Housekeeping schools and classes	17,783	5,032	11,388	34,203	14,214	48,417
Trade courses	1,351	135	3,460	4,946	35	4,981
Apprenticeship shops	194	130	92	416	1,720	2,136
For boys:						
Industrial schools (a)	48,362	23,990	46,830	119,182	7,808	126,990
Trade schools	5,495	1,853	5,209	12,557	5,198	17,755
Superior special trade schools (b)	2,089	145	193	2,427	6,333	8,760
Saint Luke trade schools	3,883	290	.....	4,173	7,179	11,352
Apprenticeship shops for stone cutting	986	386	290	1,662	794	2,456
Apprenticeship shops for weaving	6,603	1,968	3,200	11,771	1,083	12,854
Trade courses	134	19	155	308	.....	308
Total	104,888	37,511	90,083	232,482	70,011	302,493

a Including Superior School of Textiles, Verviers.
b Superior Textile School, Verviers, included in industrial schools.

Other institutions mentioned in the latest Belgian report as having received subsidies, but which are not considered in this report, are the language and commercial courses, the Superior Institute of Commerce, at Antwerp, and the Provincial School of Industry and Mines, at Mons. Their total cost was 211,043 francs ($40,731), of which sum the State granted 68,211 francs ($13,165), the provinces 35,512 francs ($6,854), and the communes 33,828 francs ($6,528), leaving 73,492 francs ($14,184) to be made up in fees, gifts, etc. Besides the amount of subsidies mentioned above, the general Government spent 66,857 francs ($12,903) for the purchase of books, etc., and for inspection, bringing the total expense to the State up to 678,528 francs ($130,956).

INDIVIDUAL SCHOOLS.

In the preceding pages each of the various classes of institutions has been considered. In the following pages individual institutions will be described under the name of the class to which they belong. The order followed is the same as in the classification heretofore used.

TRADE SCHOOLS FOR FEMALES.

According to the Belgian classification, these schools are considered under three heads, namely, trade schools proper, trade and housekeeping schools, and housekeeping and trade schools. Each of these subdivisions has already been described.

Trade Schools Proper.

TRADE SCHOOL FOR GIRLS, ANTWERP.

The Antwerp trade school for girls was created in 1874 by private effort. In 1876, however, it was recognized by the commune as performing an important social work, and accordingly was placed on the

list of institutions receiving aid from the city. In 1880 it was recognized by the State and given a share in the general appropriation for trade and technical education.

The purpose of this school, which is now a communal institution, is to prepare girls for entering the different trades open to women, without the necessity on their part of serving an apprenticeship in the shops. The city has erected a new building for the accommodation of the school. The corps of teachers in 1896 numbered 23. Pupils are admitted to the school and into the shops from 12 years of age upward. They must know how to read and write and perform simple arithmetical operations.

There is a general course of instruction, which must be taken by all the pupils. It relates to such subjects as the French and Flemish languages, arithmetic, the elements of natural history, physics, chemistry, hygiene, domestic economy, drawing, geometry, singing, gymnastics, etc. The special or trade instruction comprehends a number of distinct trade courses, on commerce, sewing and dressmaking, the making of artificial flowers, millinery, industrial drawing and ornamentation for embroidery, braid work, painting on china and textiles, and drawing after casts and from nature.

The duration of the general course, including two preparatory years, is five years. The trade courses as a rule require three years of study, but the time may be extended. The general course is given in the morning and the special or trade courses in the afternoon. There is a tuition fee of 60 francs ($11.58) a year, but great liberality exists in the matter of the remission or the grant of whole and part scholarships.

In 1875 the number of pupils was 60; in 1885, 166; in 1895, 261, and in 1896, 279. During the period 1892 to 1896, 62 students completed the course in accounts, 52 that of dressmaking, 19 that in artificial-flower making, and 19 that in lingerie making, etc. Specimens of the best work of the pupils is purchased and placed in a museum attached to the school. The total annual expenditure for the school is between 45,000 and 50,000 francs ($8,685 and $9,650), of which something over one-fourth is derived from tuition fees. It is stated in the Government report that this school is one of the best of its class in the country.

TRADE SCHOOL FOR GIRLS, 26 RUE DU POINÇON, BRUSSELS.

The trade school for girls situated in 26 rue du Poinçon, Brussels, is one of the most important trade schools for girls in the country. It was created in 1873 by private initiative. In 1874 the city of Brussels began the grant of yearly subsidies to it and it is now a communal school. There has been a steady increase in attendance. The school started with 65 pupils. In 1878 this number had increased to 161, and

in 1896 to 295. The school is satisfactorily housed in a large building containing ten rooms and a drawing-room. There are also a covered court, a garden, and a building for the accommodation of the directress.

As in most of the trade schools for girls, there are the two divisions—general studies and technical or trade studies. The general studies are similar to those of the school just described. The trade courses relate to commerce, dressmaking, drawing, lingerie making, embroidery, millinery, and corset making. The following table shows the number of students completing each of these courses during the years 1885 to 1896, inclusive:

STUDENTS COMPLETING COURSES AT TRADE SCHOOL FOR GIRLS, 26 RUE DU POINÇON, BRUSSELS, 1885 TO 1896.

Courses.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	Total.
Commerce	3	9	5	10	4	5	5	11	6	6	5	10	79
Dressmaking	3	5	11	12	15	9	13	14	12	17	16	16	143
Drawing	1	.....	.....	.....	.....	2	1	.....	3	.....	.....	.....	7
Lingerie making	.....	.....	1	.....	1	.....	1	.....	1	1	.....	1	6
Embroidery	1	1	.....	.....	1	.....	2	3	.....	4	3	1	16
Millinery	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	4	8
Corset making	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1
Total	8	15	17	22	21	16	22	28	22	28	28	33	260

The duration of studies is usually four years, but the time may be extended. Upon graduation the students, according to reports, find no difficulty in securing employment. The expenditures in behalf of the school amount to about 40,000 francs ($7,720) a year, of which between one-third and one-half is obtained from the tuition fees.

COMMUNAL TRADE SCHOOL FOR GIRLS, MONS.

This school is one of the oldest institutions in the Kingdom for giving trade instruction to girls. It was created by the communal authorities in 1877 and opened its doors in 1878. The purpose of the school is to give to young girls both a superior primary education and a practical training in various trades or professions. The general course is given in the morning, and includes ethical instruction, French, arithmetic, elements of geometry, commercial accounts, bookkeeping, commercial correspondence, history, geography, natural sciences, drawing, singing, gymnastics, etc. The trade instruction is given in the afternoon. It includes a course in the making of lingerie, etc., one in garment cutting and making, one in industrial drawing and painting and ceramic painting, one in artificial-flower making, and, since 1896, courses in millinery work and embroidery.

The duration of studies is three years. There are 13 teachers in addition to the directress. For admission pupils must be at least 12 years of age and have had a primary education. The tuition fee is 24 francs ($4.63) a year. In 1896 there were 105 pupils in attendance. The cost of maintenance of the school during that year was 23,000 francs ($4,439).

BISCHOFFSHEIM TRADE SCHOOL FOR GIRLS, BRUSSELS.

This school was created in 1865. It is the pioneer trade school for girls in Belgium. A sketch of its early history has been given in connection with the general description of trade schools for girls. This school was first subsidized in 1868. It remains under the control of the Association for the Trade Education of Women, who founded it, and this association delegates the immediate supervision to an administrative committee of 15, elected from its membership.

The duration of studies is generally four years. The courses are of two classes—the general course, which all pupils must follow, and the trade courses, which are elective. The minimum age for entrance is 12 years. Tuition was 36 francs ($6.95) per year at first, but it has been increased from time to time until in 1898 it amounted to 144 francs ($27.99). There are numerous scholarships.

The general course includes the teaching of such branches as French and Flemish, arithmetic, history, geography, elements of the natural sciences, hygiene, domestic economy, singing, etc. Cooking is also taught, as it has been thought that this art is a necessary adjunct to a girl's proper education. The trade courses are numerous, and, in this class of schools, assume a greater importance than does trade teaching in the other classes of schools for girls. The most important courses are drawing (including designing for lace, embroidery, etc.), painting on porcelain and china, painting on fans and textiles, painting on glass, dressmaking, lingerie, artificial-flower making, and millinery. They are all of the most practical character.

Drawing receives much attention, as it forms the ground work of instruction in many of the trade courses taught in the school. The dressmaking course attracts the largest number of students. Many pupils are enrolled in more than one course. Thus every pupil in the painting and embroidery classes must at the same time take all or a part of the course in drawing. It is also customary for those in the millinery class to take the course in artificial-flower making, that work being a natural complement to their trade education.

The outline of work done in 1898 in some of the most important courses follows. Taken in connection with a similar outline for the trade school for girls at Verviers, it offers a general view of the work done in this class of schools. The programme is arranged by the council of fifteen at a stated annual meeting and must be strictly adhered to until changed.

DRAWING, INCLUDING DECORATIVE COMPOSITION.

(Course 4 years; lessons 3 times a week, 3 hours each.)

First year: Exercises in freehand, outline, or shaded drawing from prints; drawing leaves, flowers, and common objects from nature; drawing solid objects, foliage, and ornaments in relief.

Second year: Drawing ornaments, faces, and torsos from casts. Simple composition—combinations of geometric lines and elementary flower forms. (Painting is done in connection with this year's work.)

Third and fourth years: Drawing heads and faces from casts. Composition is further developed. Application of composition to selected forms, having especially in view the courses in painting on porcelain, china, and textiles, etc., and the course in embroidery.

Theoretical work—First year: Lineal drawing; geometric outlines, colored.

Second year: Elementary instruction concerning projection and perspective.

Third year: History of art; notes on the character of architecture, sculpture, painting, and the decorative arts, from ancient times to the present; sketches.

PAINTING.

(Course 4 years; lessons 3 times a week, 3 hours each. This outline includes work done in all three courses in painting.)

First year: Tracing—study of the principal tracings in use in ornamentation; simple and complex tracings done with instruments; exercises with charcoal. Colors—preparation and employment of colors; handling of brushes; stretching and placing of canvas, dry and oiled; various ornamentations in water colors; progressive work in color decorations with pencil or brush; enlargement and arrangement of designs adapted to objects to be decorated. The sketches must be done in water colors.

Second year: Study of flowers and birds from colored lithographs; arrangements and compositions; shaded back-grounds and blended colors. The work for this year, comprising the study of the flower in its simple aspects, is made a part of the section devoted to ornament, that the professor may teach those graduated hues that occur in shaded ornamentation.

Third and fourth years: Study of decoration for shaded ornamentation; use of gold leaf; enamel in relief and enamels superposed; illumination in gold; monograms and coats of arms. Studies from nature of plants, flowers, and birds. Sketches in water color or gouache for painting on china; decorative flowers (composition and work done from drawings or from nature). Heads—study of the head in monochrome, or in black and white, from engravings or casts. Landscapes and animals in monochrome. Fans—pupils who take the course in fan painting are required to take that part of this course which relates to flowers.

All pupils taking the course in painting must also take the course in drawing.

DRESSMAKING.

(Course, 4 years; work every week day from 9 a. m. to 12 m. and from 1.30 to 4 p. m., except Thursday.)

First year: Work on samples; practice in fancy stitches; cutting and making of the following articles—chemises; plain drawers; work aprons and fancy aprons; infants' aprons; underskirts with flounces, pleated or gathered; yokes for skirts; pockets; morning gowns, loose at neck or turned back; underwaists for infants; infants' robes, English style; plain sleeves; sailor collars.

Second year: Cutting, fitting, altering, and making the following articles—turnover collars, infants' robes, sailor suits for boys, underskirts with ruffles, long skirts (plain cut), girls' dresses, waists with straight pleats and two small side bodies, aprons, collars, and morning gowns.

Third year: Continuation of the same operations on girls' dresses; waists with pleats running bias (fitting and altering); cutting, by different models, the various styles of cloth waists (various kinds of sleeves), dressing gowns, linings for skirts, fitted wraps, fitted coats, pelerines.

Fourth year: Loose wraps, sacques, long coats, skirts with trains, waists for ball dresses, evening wraps, boléros, and different kinds of collars; cutting, fitting to forms, and putting together waists, linings, boléros, skirts, etc.

MAKING OF LINGERIE, ETC.

(Course, 4 years; hours same as for dressmaking course.)

First year: Fancy stitches, scallops. Cutting and making the following articles—layettes, swaddling clothes, neckerchiefs, braces, small clothes, cap of three pieces, bibs, cloaks, English robes, underdresses, nightdresses, infants' aprons, collars, shirts, drawers, fancy aprons, pillowcases, sheets.

Second year: Work on underskirts (trimmed), shirts, drawers (different patterns), flannel corset covers, morning gowns (fitted), dressing gowns (by patterns), shirt waists, waists with two side bodies, infants' dresses from various models, baptismal cloaks, pelerines, knit socks, embroidery, openwork, and table linen.

Third and fourth years: Nightgowns for women (different patterns), morning gowns, dressing gowns, shirt waists (trimmed, with different styles of sleeves and collars), waists with bias pleats, boléros, men's shirts, baptismal robes, trimmed caps, cloaks for infants, children's hats, table linen, openwork and various kinds of embroidery. Cutting, fitting, altering, and making of the articles mentioned.

MILLINERY.

(Course, 3 years; 3 half days a week, 3 hours each.)

First year: Preliminary exercises—stitches used in millinery; drawing, cutting, and making (from given measurements) plain regular frames from lawn, etc.; cutting and making wire frames; foundations for hats, made of wire; making hats; exercises in simple and easy trimming; infants' caps and bonnets; fancy muffs; ornamenting with jet, spangles, etc.

Second year: Drawing, cutting, and making (from measurements) irregular and complicated frames in lawn, wire, etc.; method of sketching and designing hat patterns; exercises in trimming; cutting and making hats of stiff material, by pattern; round hats and turbans of straw, chenille, etc., according to models shown by fashion plates in journals; ornamenting with jet, spangles, etc.

Third year: Enlarging and taking in frames to fit; making frames from models and from measurements of the head; cutting and making hats from models; devising new frames by taking certain portions from various models.

Tests: Making sketches of the hat frame; making and trimming the hat.

During the course in millinery the teacher gives instructions relating to harmony of colors, and a general idea of the principal historical changes in feminine head gear.

The following table shows for each year, since the organization of the school, the number of pupils enrolled and the number taking each of the principal trade courses. Pupils frequently take more than one course.

NUMBER OF PUPILS ENROLLED AND NUMBER TAKING EACH OF PRINCIPAL TRADE COURSES, BY SCHOOL YEARS, BISCHOFFSHEIM TRADE SCHOOL FOR GIRLS, BRUSSELS, 1865–66 TO 1897–98.

School year.	Number of pupils enrolled.	Number of pupils taking course in—					
		Commerce.	Dressmaking.	Lingerie making.	Artificial-flower making.	Millinery.	Drawing and painting.
1865–66	137	(a)	(a)	(a)	.....	.....	.....
1866–67	163	(a)	(a)	(a)	.....	.....	.....
1867–68	191	(a)	(a)	(a)	.....	.....	.....
1868–69	200	(a)	(a)	(a)	.....	.....	.....
1869–70	210	98	71	21	.....	.....	20
1870–71	200	90	72	29	10	.....	8
1871–72	270	(a)	(a)	(a)	(a)	.....	(a)
1872–73	259	94	84	24	23	.....	13
1873–74	280	(a)	(a)	(a)	(a)	.....	(a)
1874–75	260	83	93	28	19	.....	64
1875–76	280	(a)	(a)	(a)	(a)	.....	(a)
1876–77	329	89	108	38	20	.....	59
1877–78	320	85	108	46	24	.....	46
1878–79	321	87	112	45	20	.....	65
1879–80	344	82	156	40	18	.....	48
1880–81	320	80	153	38	17	.....	32
1881–82	300	96	131	43	16	.....	59
1882–83	347	129	174	46	18	.....	40
1883–84	314	127	177	30	13	.....	45
1884–85	324	117	207	39	13	.....	26
1885–86	383	119	232	43	11	.....	34
1886–87	420	105	270	59	17	.....	32
1887–88	433	101	294	47	19	.....	33
1888–89	386	93	259	40	24	.....	32
1889–90	360	132	255	34	20	.....	34
1890–91	338	116	246	21	21	.....	27
1891–92	324	118	210	21	28	.....	37
1892–93	312	89	225	13	24	16	38
1893–94	266	87	194	b 11	23	13	31
1894–95	255	84	163	12	19	14	42
1895–96	242	86	136	10	17	13	38
1896–97	225	78	137	13	24	18	30
1897–98	204	67	130	11	15	15	24

a Not reported.

b Including 2 pupils taking a course in corset making.

It will be seen that the highest enrollment was for the school year 1887–88, the number of pupils being 433, since which year there has been a steady retrogression. At the latest period for which data are given, 1897–98, there were only 204, less than half the number of pupils shown for the earlier date. This is explained by the fact that many schools have been established in the city of Brussels and its suburbs during the last fifteen years, some of which are direct offshoots from this school.

A large corps of competent instructors is employed. Their number is increased whenever the school population demands it, especially in the dressmaking and drawing courses. The school is regularly inspected by the council of fifteen and by the communal and State inspectors.

Pupils are granted certificates of capability after having passed a rigid examination at the termination of their course of study. The following table shows by years for the principal courses the number of such certificates delivered since the founding of the school.

CERTIFICATES ISSUED IN THE MOST IMPORTANT COURSES, BISCHOFFSHEIM TRADE SCHOOL FOR GIRLS, BRUSSELS, 1869 TO 1897.

Year.	Course.						
	Commerce.	Dressmaking.	Lingerie making.	Artificial-flower making.	Drawing.	Painting.	Total certificates.
1869	3						3
1871	3						3
1872	3	4					7
1873	2	1			2		5
1874	2	4			1		7
1875	6	3	1		2		12
1876				1	4		5
1877	2	1	1	2			6
1878	8	5	1	1			15
1879	4	7	1	2	1	1	16
1880	2	5	1	3		1	12
1881	2	10	1			4	17
1882	2	15	5	1		4	27
1883	10	8	3			3	24
1884	10	8	3			4	25
1885	6	6	2	1			15
1886	12	14	3	3		2	34
1887	6	24	3	3	1	4	41
1888	7	26	5	1	1	3	43
1889	17	19	4	3		3	46
1890	10	29	3	2		6	50
1891	10	21	5	3		7	46
1892	8	19	2	4		2	35
1893	4	18	3	4		5	34
1894	7	18				5	30
1895	9	16		3	1	2	31
1896	10	12		4		6	32
1897	10	11	2	4			27
Total	175	304	49	45	13	62	648

In former times prizes were given to the most meritorious pupils. These have been replaced by free excursions which are given during vacation. At the end of the school year an exhibition is held showing work done by the pupils.

Receipts are derived from dues of members of the association, gifts from individuals, tuition fees, subsidies from the city of Brussels and suburban communes, and subsidies from the State and province. Receipts for a number of years exceeded expenditures, but since 1892 the reverse has been true. The largest receipts for any year were for 1889, the amount being 77,493 francs ($14,956), and the largest expenditures were for the same year, amounting to 63,799 francs ($12,313). This was at the time of the school's greatest prosperity. For 1896 receipts were 45,800 francs ($8,839) and expenditures were 58,643 francs ($11,318).

This has been one of the most important schools in its class, and the reports say that nearly all its graduates have found lucrative positions. The association has assisted in according them a patronage.

TRADE SCHOOL FOR GIRLS, VERVIERS.

This school was organized in 1886. It owes its origin to private effort. At first the instruction given was comprised in a number of more or less independent courses, but these are now thoroughly united so as to form a very practical trade school. The object is the same

as the other schools of this class; that is, to teach girls a useful and remunerative trade and at the same time prepare them for the duties of the household.

The school has been very successful from the beginning. It was opened in January, 1887, with 72 pupils, and the next year there were 167. Since that time the figures have varied considerably.

The management is delegated to a commission of 9 members selected from the membership of a society that was formed to promote the interests of the school. It is the duty of this commission to care for the financial interests, supervise the studies, nominate the professors for the various courses, make rules and regulations, audit accounts, etc.

In 1898 the faculty comprised a directress, 3 teachers for the general course, 3 for the cutting and dressmaking course, 2 for the painting course, and 2 for drawing. The directress, in addition to other duties, has charge of the course in lingerie and classes in the commercial course. The number of pupils enrolled for this year was 156. They are, of course, largely drawn from the commune in which the school is located, but a large number attend from neighboring communes, some of which share in its support. The qualifications required of candidates for admission are about the same as in other trade schools for girls. They must be at least 13 years of age and have a primary education. Tuition is 12 francs ($2.32) per quarter, but numerous scholarships are divided among the several communes which contribute toward the support of the school.

Due attention is given to the general education of the pupils. The programme comprises the usual general course, including all the important subjects taught in the superior section of the primary schools, a commercial course, and trade courses in cutting and dressmaking, lingerie, drawing, and painting. The trade courses are the only ones with which this investigation is concerned, and the complete outline of work done, in so far as it applies to these courses, will be found at the end of this description. It is proper in this connection to indicate the distribution of pupils among the trade courses. During the school year 1897–98, 95 pupils were in the second and third years of the cutting and dressmaking course, 21 were in the same years of the lingerie course, and 46 were in the preparatory year for these courses, the work being identical for both. As for the other courses, 27 pupils took shaded drawing, 135 were in the classes in outline drawing, and 16 were in the two sections in painting. The total enrollment for that year was 156.

The following statement shows the hours per week devoted to each study:

HOURS PER WEEK DEVOTED TO EACH STUDY IN TRADE SCHOOL FOR GIRLS, VERVIERS.

Subjects taught.	First year.	Second year.	Third year.	Subjects taught.	First year.	Second year.	Third year.
Arithmetic	3	3	2	German	4	3	3
French	4	3	2	Dressmaking	6	10	12
Geography	2	2	2	Lingerie making	6	6	6
Commerce	1	3	3	Drawing—outline	2	4	2
Natural science	2	2	1	Drawing—shaded	.....	.....	4
Domestic economy and hygiene	1	1	1	Painting—Section A	2	2	2
Calligraphy	1	.....	.....	Painting—Section B	5	5	5

The general course is obligatory for all, but in the trade courses more or less freedom of selection is allowed. Expenditures for 1897–98 were 20,880 francs ($4,030). Subsidies are received from the State, the province, and the communes of Verviers, Hodimont, Dison, and Andrimont.

The full programme in use in the trade courses for the school year 1897–98 is here reproduced. It serves as an illustration of what is actually done in nearly all the trade schools for girls. That part of the programme relating to the general and commercial courses is omitted.

DRESSMAKING.

First year: (The first year's work is called the preparatory course in cutting and dressmaking and in making of lingerie, etc.) Exercises in different stitches; various kinds of sewing, gathers, buttonholes, eyelets; mending, including patching, piecing, and darning; exercises in stamping and embroidery; preparatory exercises in dressmaking, properly speaking; work on samples; application of knowledge of sewing to such ordinary work as towels, handkerchiefs, pillowcases, plain aprons, petticoats (plain and scalloped), and chemises.

Second year: Use of sewing machine; making underskirts for women; infants' gowns (method of taking measurements, tracing the pattern, cutting and preparing, fitting and making); apron with sleeves; tracing pattern, cutting pattern, then cutting and making morning gown; waist (how to measure, mark patterns, cut, prepare, fit, and make); making lined waist, plain waist, cloth skirt, dressing gown, skirts and sleeves (various models), and a plain costume.

Third year: Students review work of first two years, then work on the following articles: Street dress; various styles of waists and sleeves; waist for ball dress; making buttonholes, lapels, pockets, etc.; cutting and making jackets; patterns of wraps of all kinds—traveling wraps, visiting wraps, long cloaks, etc., and tailor-made gowns. Students learn to modify the waist pattern to fit any form. A notebook is kept by the pupils, with synopses of the lessons and sketches of the different garments and lists of articles made.

COURSE IN THE MAKING OF LINGERIE, ETC.

First year: The work for this year is the same as for the dressmaking course.

Second year: Students work on pillowcases, sheets, chemises for women and children, drawers, skirts, morning gowns, corset covers, infants' trousseaux.

Third year: Includes work on chemises, nightshirts, fine work on skirts and drawers, trimmed morning gowns, trousseaux for infants, and men's shirts.

Pupils are drilled in tracing and modifying patterns in the same manner as in the dressmaking course. They keep a notebook for this course, in which they describe the methods studied and reproduce the sketches made.

DRAWING IN OUTLINE.

First year: Tracing lines; defining lines and surfaces that occur in drawing; combining straight lines in such manner as to form ornaments based on geometrical figures taken from flower forms; combining straight and curved lines; combinations of polygons (with definitions); practice in geometric curves and various ornamentation on systems becoming more and more simple, ending in two or three lines or a few points; theory of the principal laws of perspective, illustrated by models in plaster; demonstration of elementary projection in regular polyhedrons of two surfaces; application of perspective to the study of polyhedrons and round bodies; drawing polyhedrons and round bodies, singly at first, then grouped; simple ornament drawing, gradually progressing to higher forms. (For the benefit of the pupils the teacher criticises and corrects drawings sent in from the other trade classes.)

Second year: The exercises include a repetition of the first year's work; continuation of ornamentation; drawing from nature, plants, fruits, and associated objects; study of the face, including simple demonstration of the anatomy of the face and neck, given by the teacher, who makes constant reference to a model. Students draw the skeleton of a head. Correction of drawings done by the pupils of the trade classes.

SHADED DRAWING.

Third year: The instruction includes drawing of solids, singly and in groups, with charcoal shading; ornament work, gradually progressing; practice in quick sketching and shading with lead pencil; drawing of face and bust; demonstration of anatomical knowledge of the face; drawing of skeleton of the head; drawing of plants and objects from nature; designing of clothing (taken in connection with the cutting and dressmaking course).

PAINTING—SECTION A.

The complete work of this section includes: (1) Painting from models and nature, in water colors, and in oils, as applied to such stuffs as silk, cambric, gauze, muslin, velvet, tapestry, etc., and on terra cotta, wood, leather, marble, alabaster, ivory, rubber, glass, etc.; (2) coloring photographs in water color or oil; (3) practical instruction in composition applied to painting from nature, special attention being given to the arrangement of the subject and to the harmony of colors.

PAINTING—SECTION B.

First year: (1) Study of diagram, which is the geometric base of all ornamentation; geometric designs and conventional flower in geometrical forms, washed in on paper, making the diagram stand out; (2) ornamental composition based on certain diagrams, as the rectangle, lozenge, and circle; (3) study of leaves from nature and their classification according to the diagram which harmonizes with their outline, at the same time having regard for their symmetrical arrangement; (4) the previous exercises in geometrical figures or conventional flowers are applied to monochrome or cameo painting on porcelain, faïence, glass, or stuffs, combining the decoration and material in such manner as to give just importance to both.

Second year: (1) Painting on porcelain; practice in designing, that is, the tracing in water color which precedes ceramic painting; (2) general study of harmony of

colors and mixing of vitrifiable colors for porcelain and glass, students also receiving instruction concerning the alteration which colors undergo in baking, and the mixtures to avoid; study of the texture of porcelain, faïence, and glass; (3) ornamental compositions on given diagrams and their application on porcelain, clay, faïence, glass, and rough glass.

Third year: (1) Study from nature of flowers, foliage, and fruits, with reference to their ornamental arrangement and application to ceramics; (2) theory of ornamental composition after different methods; (3) various modes of composition for objects of designated form without diagram.

Trade and Housekeeping Schools.

TRADE AND HOUSEKEEPING SCHOOL OF THE CLUB "LE PROGRÈS," SAINT-GILLES (BRUSSELS).

This school was founded in 1891 by the club "Le Progrès" and has had a prosperous career. The object in view, as is the case with all other trade and housekeeping schools, is to train young girls so that they may be able either to earn their living by some useful occupation or become intelligent, painstaking, and economical housekeepers.

To be admitted they must be at least 12 years of age and possess a primary education. The programme contains a general course intended to complete this kind of education. The trade courses include the following subjects: Dressmaking, lingerie, artificial flower making, millinery, drawing, painting, and commercial training. Considerable attention is paid to the housekeeping course. In the cooking course groups of pupils in rotation, and for one week at a time, are required to do the marketing, prepare the dinner, keep the accounts, wash the dishes and kitchen utensils, etc., under the direction of an instructress. The menu is changed every day. One afternoon each week a group of pupils is detailed for the wash room and to do the different operations necessary in washing and ironing.

The school year closes with an exhibition of work done by the pupils. Prizes were awarded in the past, but they have been superseded by excursion trips.

In 1895–96 there were 90 pupils, and 1 directress and 11 teachers were employed. Subsidies are allowed by the State, the province, and the commune.

This is one of the most important schools of the class known as trade and housekeeping schools.

TRADE AND HOUSEKEEPING SCHOOL, SCHAERBEEK.

This school was organized by the commune in 1889 with the cooperation of the State and province. The courses are of the same character as in the other schools of the trade and housekeeping class.

The general course includes French and Flemish, arithmetic, history, geography, hygiene, domestic economy, maternal pedagogy,

natural science, ethics, penmanship, and geometric drawing. The trade courses include commercial science (bookkeeping, correspondence, etc.), drawing (such as is required in the trades taught), the making of lingerie, etc., dressmaking, embroidery, washing, bleaching, ironing, mending, and practical work in cooking, etc. The housekeeping course includes instruction and practice in buying and preparing food, the cleaning and proper care of the house and furniture, washing, mending, cutting, and making the ordinary wearing apparel necessary for the family, in fact, all the various occupations of the housewife.

The programme covers three years of study and all courses are obligatory upon the pupils. More attention is given to the practical than to the theoretical side of the instruction. Pupils are admitted between the ages of 12 and 16 if they have a sufficient primary education.

The expenditures for 1895–96 were 12,300 francs ($2,374). There were 6 teachers and 60 pupils.

TRADE AND HOUSEKEEPING SCHOOL, 102 RUE TERRE-NEUVE, BRUSSELS.

This school was created in July, 1888, by the Association for the Trade Education of Women, the same association that founded the Bischoffsheim school (trade school), rue du Marais, in 1865.

Pupils are admitted at the age of 12. The tuition fee is 21 francs ($4.05) per quarter, and scholarships may be given. Girls who have attained the age of 16 and have entirely completed their primary school education may take single trade courses, paying 10 francs ($1.93) a month tuition for each course.

The programme contains courses of study extending over a period of three years. The general course is of a very utilitarian character. Besides the ordinary school studies it includes such branches as hygiene, domestic economy, maternal pedagogy, accounting, and drawing. Such domestic duties as mending all kinds of clothing, washing and ironing linens and other wearing apparel, cleaning of the house and furniture, etc., are also taught in connection with this course. This course is obligatory on all regular pupils.

The trade courses comprise: Dressmaking and the making of lingerie, etc.; millinery; artificial-flower making, jet work, and feather curling; a commercial course, and a cooking course.

In the cooking course are taught the preparation of meals suitable for the laboring and bourgeoise classes and adapted to the season, the art of preserving, of provisioning the household, and of utilizing what is left over from meals. While taking this course the pupils do the marketing, prepare the dinner, wash the dishes, clean the kitchen and dining room, etc. They also do at intervals the various operations necessary in washing and ironing the linen. The school's working hours are from 8.30 to 11.30 in the morning, and from 1.30 to 4.15

in the afternoon. Trade teaching occupies one half the day and the general and housekeeping courses the other half.

This school opened in 1888 with 28 pupils, and in 1896 it had 110. Thus it may be seen that it has been one of the most successful schools of its class. The faculty comprises a directress, who, in addition to her other duties, has charge of the maternal pedagogy class, and 10 or 11 other teachers.

The institution is directed by an administrative committee, chosen from the membership of the association by which it was created.

Expenditures during 1895–96 were 25,800 francs ($4,979), partly met by subsidies allowed by the State, the province, and the commune.

TRADE AND HOUSEKEEPING SCHOOL, 10 RUE DE LA ROUE, BRUSSELS.

This school was created by private initiative. When opened, November 15, 1894, it took over and improved the trade and general courses that had previously been attached to another school. The building is well situated as regards light and air. It contains kitchens, a laundry, drawing room, four class rooms with an average capacity for 20 pupils, and two smaller class rooms. The furnishings are not complete. The school is placed under the administration of a committee of ladies.

Both general and trade courses are given. The general course includes ethics, French, Flemish, arithmetic, geometry, elements of commerce, history, geography, calligraphy, music, gymnastics, elements of the natural sciences, hygiene, and domestic economy. The trade courses include the making of lingerie, etc., dressmaking, millinery, artificial-flower making, feather working, jet work, and drawing as applied to the subjects just mentioned. There is also a housekeeping course, the object of which is to give the pupils a practical knowledge of the duties appertaining to the household. The general course occupies the morning hours, and the trade and housekeeping courses the afternoon.

Pupils must be at least 12 years of age, and must possess an average degree of primary education before they are qualified to enter this school. The tuition fee is 100 francs ($19.30) per year. Diplomas and certificates of capability are issued to pupils after passing a rigid examination before a board named by the administrative committee. In 1895 there were granted two diplomas and six certificates, and in 1896 three diplomas and three certificates. There were 75 pupils enrolled during the latter year. The faculty comprises a directress, an assistant directress, and 11 teachers. Expenditures for the school year 1895–96 were 13,093 francs ($2,527), not including rent, taxes, repair of buildings, etc. These expenditures are met by subsidies from the State and province, by tuition fees, and donations. A certain amount is contributed according to needs by a committee of patronage.

TRADE AND HOUSEKEEPING SCHOOL, HEVERLÉ.

This school was established at Louvain in 1887 by private initiative. Its object is to give instruction in housekeeping and such trades as dressmaking and the making of lingerie, etc., to the children of the laboring and the poorer middle classes. An apprenticeship shop is maintained in connection with the school. Instruction in this school has been not only absolutely free, but for some time a small wage, varying in amount according to ability, has been paid to the pupils.

Pupils are admitted at the age of 13 if they have finished their studies in the primary schools. The course is for three years, but those who have not thoroughly learned their trade may attend for a longer period.

Instruction is given in the forenoon from 8 to 11.30, and in the afternoon from 1.30 to 4.30 in winter, and from 1.30 to 6 in summer, every week day except Saturday. The pupils are divided into groups, and each group in turn receives instruction in housekeeping for one week at a time.

One directress and 7 mistresses comprise the personnel of the faculty. There were 175 pupils in 1896, the last year for which data are accessible. The expenditures that year were 7,050 francs ($1,361). This was partly met by the government subsidy of 2,300 francs ($444), and the other expenses were met by private subscription and the sale of the products of the school.

The increasing success of the school led to its enlargement and removal to Heverlé, near Louvain, where for some time to come it will be able to meet all demands for admission.

Housekeeping and Trade Schools.

HOUSEKEEPING AND TRADE SCHOOL, TOURNAY.

This school, which has been in existence since April 21, 1890, is annexed to another institution (l'institution Monnel, Monarre et Crombez). Its object is to give the young girls of the laboring and poorer middle classes a knowledge of housekeeping, and to teach the work of garment cutting, dressmaking, repairing, washing, etc. The instruction is both theoretical and practical.

The general course, including hygiene, domestic economy, commerce, French, and arithmetic, is followed by all the pupils at the same time, but for the trade instruction the pupils are grouped according to the nature of the work, each group doing one kind of work for one week, then exchanging places with another. The older pupils sometimes act as monitors. The course is for two years, and pupils are admitted at the age of 14, after having finished their primary-school studies. The tuition fee is 8 francs ($1.54) per quarter, but there are some scholarships. Instruction is given every day of

the week from 8.15 a. m. to 12 m., and from 2 to 4.30 p. m. during the winter months, and from 2 to 5 p. m. in summer. The mornings are devoted to training in household work and the afternoons to the sewing and other classes. Theory is taught in the evening from 5 to 7 o'clock.

There has not been a very rapid increase in the number of pupils attending this school, and at present 2 teachers for the practical part of the work and 1 for the theoretical instruction are sufficient.

The school is subsidized by the State, the province, and the commune. The expenditures were about 4,000 francs ($772) during the year 1895–96.

TRADE COURSES FOR FEMALES.

There are only three institutions in this class, one at Brussels and two at Josse-Ten-Noode. The former is a continuation course for graduates of trade schools and is by far the most important. The courses in Josse-Ten-Noode are annexed, one to a primary and one to an intermediate school. They are intended to supply the place of trade schools. A short account of the courses follows:

CONTINUATION COURSES IN DRESS CUTTING AND MAKING FOR GRADUATES OF GIRLS' TRADE SCHOOLS, BRUSSELS.

It was found that there were a certain number of girls who were desirous of gaining a more thorough training in the trade of dressmaking than could be obtained in the ordinary trade schools. Especially was it desired to receive instruction regarding fashions and costumes of different periods and countries in order that original designing of costumes might be undertaken. To meet this need the inspector-general of technical education proposed to the Government the creation of an advanced course in such matters at Brussels that should be open to graduates of the girls' trade schools. This recommendation was favorably received and such a course was formally opened in October, 1895. The course of instruction includes two years' attendance and comprehends a study of dress from the earliest times and in all countries.

TRADE COURSES, JOSSE-TEN-NOODE.

Rue de la Limite: In 1886 the commune of Josse-Ten-Noode added to one of its primary schools a system of technical instruction for young girls desiring to learn a trade. This includes the general course consisting of the same studies as apply to primary schools, and the trade courses of cutting and dressmaking (theory and practice), the making of lingerie, etc., commerce (French and Flemish, accounts, commercial studies, commercial geography), and drawing are also taught. The course in dressmaking lasts four years, that in the making of lingerie, etc., three or two years according to the aptitude of the student, and that in commerce three years. Instruction is given

every week day. The hours per week for each course are: Cutting and dressmaking course, 13; lingerie course 13; commercial course, 10; general course, 17; drawing, 2. The number of students taking these courses has gradually increased during recent years, it being 32 in 1887 and 48 in 1896.

Rue Musin: In 1887 the same commune annexed to its intermediate school a technical department in which is given a four years' course of instruction in sewing, cutting, and dressmaking; a four years' course in painting and drawing, and a three years' course in languages. In 1896, 72 students followed these courses, of whom 61 took that of dressmaking. Students in the school are free to choose whether they will follow the trade courses or not. The general course is that of the intermediate school. One half of each week day is given to trade teaching, the other half being taken up by the regular school studies.

APPRENTICESHIP SHOPS FOR FEMALES.

There are now four apprenticeship shops for girls in Belgium. They are the least important of all the classes of institutions for girls. Following is a description of the oldest of these institutions:

APPRENTICESHIP WORKSHOP AND HOUSEKEEPING SCHOOL, JEMELLE.

An apprenticeship workshop for girls was created at Jemelle in 1877 through the joint action of the commune, the province, and the State. In 1890 a housekeeping school was annexed to it.

In this school are taught hand and machine sewing, the making of ordinary garments, knitting, washing, mending, and ironing of linen goods, culinary operations, and all the accessory work which must be done by a good housekeeper or working woman in the country. The school occupies comfortable quarters and possesses a satisfactory equipment. Instruction is gratuitous. The course lasts two years. Instruction is given every week day from 8 to 11.30 in the morning and from 1 to 4 in the afternoon during the winter, and from 4.30 to 6.30 in the summer.

Stores and individuals furnish work to be done by the pupils. During the first three months the pupils are not paid for their work. Afterwards they are remunerated according to the value of the work they do. During one day in each week they can do work for themselves. Five per cent of their earnings is retained by the school to pay for the expenses incurred in washing materials, loss of articles, etc. The school is administered by a commission composed of the mayor and two others, one appointed by the communal council and the other by the permanent deputation of the province.

The school had an attendance of 83 pupils in 1896. Its cost was only 1,200 francs ($232) for the workshops and 1,425 francs ($275) for the housekeeping school.

INDUSTRIAL SCHOOLS.

The term industrial school, as used in Belgium, has been defined as a school in which is taught a number of technical subjects relating to industrial operations. It has been seen that in Belgium all schools of this class hold either night or Sunday sessions, or both, there being no regular day schools in Belgium bearing the title industrial. Hence, they are continuation schools and may be classed with the industrial continuation schools of other countries. Although these schools differ greatly in regard to their programmes, each school being organized with reference to purely local needs, there is no such variation from a general type as is to be found in the trade schools. For this reason a few representative industrial schools only have been selected for description.

INDUSTRIAL SCHOOL, ANTWERP.

This school was created in 1860 and was at first supported by a society called the Flemish *Vrienden*. It was established for the purpose of giving to artisans and laborers useful knowledge pertaining to the theoretical part of their trades. At first instruction was mainly in ornamental and architectural drawing.

In 1866 the school became communal, since which date it has been subsidized by the city, the province, and the State. As at first organized the school did not produce the results expected, so the communal council modified the programme in 1894, making it conform more nearly to the requirements of the trades represented in the city.

The administrative commission of the school is composed of members named by the communal and provincial authorities and approved by the Government. The mayor or his representative (an alderman) presides at the meetings of the commission.

A corps of 19 teachers is engaged in giving instruction.

The programme comprehends five years of study. For the first three years the studies are common to all, and comprise drawing, arithmetic, commercial arithmetic, algebra, geometry, bookkeeping, and physics. Specialization then occurs, and the student passes the next two years in one of the following departments:

1. Department of mechanics. In this department the student studies mechanics, physics, chemistry, and drawing and designing of machinery.

2. Department of civil constructions and architecture. This includes the study of physics, architecture, drawing and designing applied to architecture, estimates, etc.

3. Department of naval construction. In this section are taught drawing (and designing) applied to naval construction, the theory of naval construction, physics, and chemistry.

4. Department of painting (imitation of marble and wood). Study of theory.

5. Department of marble cutting and setting. Study of theory.

In all five departments are included the study of industrial legislation, political economy, and hygiene.

Drawing occupies a prominent place in the plan of instruction. During the first year all students are taught linear drawing and ornamentation, but for the second and third years the drawing done by the student conforms to the work in the department he intends to enter.

The school year begins the first Monday after the 15th of September and ends the 30th of April. The class hours are from 6.30 to 8.30 p. m., but the department of painting in imitation of wood and marble receives instruction on Sunday from 9 a. m. to 12 m. Instruction is gratuitous, but a registration fee of 1 franc ($0.19) is charged. Boys 14 years old may be admitted if they understand the fundamental principles of arithmetic. Special students (those taking only studies of their own selection) may be admitted when there is room for them.

Regular students are allowed to enter an examination at the end of five years. If they successfully pass it they are given a certificate of proficiency in the department in which they have specialized.

Since 1891 the school has occupied a building formerly used as a boys' orphanage. The accommodations had been insufficient and a number of applicants had been turned away during the last two years preceding the issuance of the report. The commune has built several additional rooms, however, and has installed a chemical laboratory and renewed the furniture. The school library contains 4,000 volumes, to which students have access.

Since the reorganization in 1894 the school has made rapid progress. There were 348 matriculants in 1896, of whom 317 were classified as laborers, artisans, etc., 19 were schoolboys, and 11 were clerks, etc. Only 1 had no occupation. The attendance at the end of the school year was about 80 per cent of the total enrollment.

INDUSTRIAL AND COMMERCIAL SCHOOL, CHARLEROI.

A school for mine bosses (*porions*) was founded at Charleroi in 1845 by the provincial council of Hainaut and annexed to the communal college. This institution met with little success. In 1865 a reorganization was effected and the school took the name of Industrial School of Charleroi. From that time rapid progress was made and the school became one of the most important in the kingdom.

Charleroi was then, as at present, the center of large and diversified industrial interests, and was an ideal locality for an industrial school which should teach a variety of subjects bearing on industrial work. At that time industrial schools were not numerous and those in existence were confined more or less closely to giving elementary instruction relating to local industry.

In view of these conditions the school at Charleroi was conducted

under an organization unlike that of other industrial schools. It did not have a definite programme of studies systematically arranged, but a collection of independent branches or courses. There were no departments with obligatory studies and no obligatory general courses, as in the case of schools which granted diplomas. The student was allowed to choose such separate branches or subjects as he pleased. After a time, varying from two to three years, according to the importance of the subject, the student was given a certificate of graduation in the branches chosen if he passed a satisfactory examination in them.

This system met a real need for many years. It enabled the young men of the neighboring communes to complete the industrial education begun in smaller schools, affording them the opportunity to study special branches that were not then taught in most schools. Attendance increased rapidly. During the ten-year period preceding the date of the last Government report there was an average annual matriculation of 912. At one time this school was spoken of as the Industrial University of Belgium.

In time the rapid increase in the number of industrial and trade schools and the higher and more perfect organization of their courses in accord with local needs diverted many students from the Charleroi school and otherwise interfered with its usefulness. The necessity of a more modern programme of definitely arranged departments for industrial instruction, including correlated branches of study, which should be obligatory, became more and more apparent. This necessity was mentioned in the Government report of 1897, and steps were taken to bring about the change. In 1898 the reorganization was effected and the school took its present name. Under the present régime the school is more local in character, the departments being arranged with reference to local industries. All branches of study in any department are obligatory if one aspires to a diploma.

The exact arrangement of the departments and their number have not as yet been reported. The subjects taught include arithmetic, geometry, geometric drawing, projection, industrial drawing, artistic designing, physics, chemistry, mechanics, Flemish, topography, and industrial economy. There is also instruction in such specialties as firing and the care of machinery, engineering, mining, leveling, building construction, shop technology, metallurgy, electricity, and commerce.

Instruction is given four days a week, from 7 to 9 p. m., and on Sunday morning from 8 to 12. The school term begins October 1 and closes at the end of July. An entrance fee of 6 francs ($1.16) is charged, but this is returned to those students of the commune who attend regularly. Tuition is free. Students are admitted at 14 years of age.

There has been a marked recession from the old-time attendance, there being but 640 students enrolled in 1899–1900. These were

grouped according to ages, as follows: From 14 to 16 years, 146; from 16 to 18 years, 161; from 18 to 20 years, 172; 20 years or over, 161. A great percentage of the students came from other communes, the number being 535. About 83 per cent of the 640 students were in attendance at the end of the year.

In 1900 there were 34 diplomas delivered, of which 6 were in mining, 4 were in steam-engine firing, 1 was in building construction, 1 in shop technology, 1 in metallurgy, 7 in electricity, 3 in applied chemistry, 9 in commerce, and 1 was for building foreman. One surveyor's certificate was granted by the provincial jury.

A number of prizes, varying in value from 25 francs ($4.83) to 150 francs ($28.95), are placed at the disposal of the school each year by industrial associations, individuals, etc.

Twenty-four teachers, the director included, are employed.

The school is subsidized by the State, province of Hainaut, various communes, etc.

INDUSTRIAL AND COMMERCIAL SCHOOL, CHÂTELET.

In point of attendance this is one of the largest industrial schools of Belgium. It was founded in 1869 by the city, with the aid of the State and the province of Hainaut. Since the Government report of 1897 was issued there has been a complete reorganization of the school. In that report it was remarked that too much latitude was allowed the student in the choice of studies and that the choice was not always judiciously made. It was suggested that there should be an increase in the number of special technical departments and that each department should carry its appropriate branches. It was to be obligatory upon students in any department to study all the branches pertaining to it. This suggestion was followed and the change has been accomplished.

The duration of study is now five years, three of which are devoted to a general or preparatory course and two to the technical courses. This division of time applies to both Sunday and week-day students. The general or preparatory course includes the study of French, Flemish, commerce, mathematics, elements of mechanics, freehand drawing, projections, and perspective. After three years of preparation there is a division of the industrial part of the instruction into the following departments, each requiring two years of study:

1. Department of mechanical drafting: This department requires trade drawing and study of physics, shop technology, and industrial economy.

2. Department of electricity: This includes drawing applicable to electricity and the study of physics (more especially that branch relating to electricity) and industrial economy.

3. Department of mining: Here are taught the theory of the development of mines, industrial economy, and dialing or surveying of mines.

4. Department of metallurgy and chemistry: This includes trade drawing and visits to industrial establishments and the study of metallurgy, chemistry, and industrial economy.

5. Department for firemen, etc.: This includes drawing applicable to the subject and study of mechanics, industrial economy, and firing.

6. Department for building contractors: This includes building construction, drawing applicable to the building industry, and industrial economy.

A course in practical electricity was organized in 1898. It forms part of the Sunday programme.

There are two special courses. In one the object is to prepare students for the provincial examination for surveyors. It includes arithmetic, algebra, geometry, surveying, leveling, dialing, physics, and industrial economy. The second is a commercial course, in which students study banking, partnership, the industrial and commercial geography of Belgium, commercial law, freight rates, industrial economy, etc.

In the scheme of instruction above presented drawing occupies a prominent position, as, in fact, it does in all trade and industrial schools. In this school drawing from prints was formerly the rule, but this custom has been entirely superseded by sketching from wooden models or directly from the parts of machinery.

Students are admitted at the age of 14, but in exceptional cases they may enter at 12 or 13. Tuition is free to residents of the city, but nonresidents pay 3 francs ($0.58) a year. The sum realized in this manner is applied to the purchase of books, etc., which are distributed as prizes at the end of the year.

There are a Sunday and an evening division. Recitation hours are from 7.30 to 9.30 p. m. every week-day evening and from 8 to 12 Sunday morning.

The school population is increasing each year. In 1895–96 it was 883. The short table which follows shows the increase in attendance for each year of the period 1896–97 to 1899–1900. It also shows the character of the employment of the students. The data are derived from the official report of the inspector of industrial schools for the province of Hainaut.

ENROLLMENT AND CHARACTER OF EMPLOYMENT OF STUDENTS, INDUSTRIAL AND COMMERCIAL SCHOOL AT CHÂTELET, 1896–97 TO 1899–1900.

Character of employment.	School year.			
	1896–97.	1897–98.	1898–99.	1899–1900.
Mine employees	63	55	59	50
Industrial employees (ouvriers d'industrie)	287	312	341	404
Agriculture	28	32	28	21
General trades, occupations, etc	208	215	255	275
Professional	12	60	78	82
Clerks, office help, etc	132	135	138	142
Schoolboys, students, etc	198	167	159	168
Total	928	976	1,058	1,142

It is seen that with the exception of a small percentage of schoolboys, students, etc., all were engaged in gainful occupations. The total enrollment during the school year 1899–1900 was 1,142, of which number 372 were enrolled in week-day classes only, 560 in Sunday classes only, and 210 in both Sunday and week-day classes. There were 705 students 16 years of age or over, 425 of 18 years or over, and 165 were above 20 years old.

Of the 1,142 students enrolled about 22 per cent had dropped out of the classes before the end of the year. This defection is less than the average for the schools of the province.

Certificates of capacity are given in all courses, except the special course for surveying, to students who pass an examination with an average of 60 per cent at the end of the five years' course. Students who take the surveyor's course must pass the examination before the examining board for the province of Hainaut. In 1900 there were 60 certificates of capacity awarded, and 18 students passed the surveyor's examination.

There are 19 teachers, including the director, engaged in the various departments.

This school occupies a building in common with the intermediate school. Subsidies are received from the State, the province of Hainaut, and the commune.

INDUSTRIAL SCHOOL, GHENT.

The Industrial School of Ghent dates from the year 1828. As first organized but little was accomplished in the way of training workingmen, as the instruction was too scientific or theoretical. In 1833 the school was reorganized in conformity with local needs, and was made a communal institution. In 1835 a special course in designing of machinery was added. This was for foremen, directors, and draftsmen of the industrial establishments of Ghent, who had formerly been compelled to go to England and Germany for such instruction. In 1836 the studies were divided into two departments—one in French for advanced students, and the other in Flemish for ordinary workmen.

In 1856 a new course for firemen and engineers was created. An independent school of industrial drawing and weaving was founded in 1852 and in 1860 the two schools were united under the name of Industrial School, the courses of both being reorganized. In 1893 the school was again thoroughly reorganized by a special commission consisting of delegates from the city, the province, and the central Government.

Under its present organization the object of the school is stated to be to train firemen, engineers, electrical workers, building trades artisans, painters and decorators, mechanical draftsmen and draftsmen for building construction and the art industries, and foremen and heads of establishments in the textile, mechanical, and chemical industries.

The teaching staff includes a director and 23 instructors, among whom are a number of eminent specialists. The courses are so arranged that in two, three, or four years students may prepare themselves for diplomas in any one of the following specialties: Mechanical industries (3 years); chemical industries (3 years); textile industries (3 years); as designers and industrial decorators (4 years); as firemen (2 years); as firemen and enginemen (2 years); and as electrical workers (2 years).

Instruction in some branches is in Flemish, but in others French is used. The branches taught are: In Flemish—arithmetic, algebra, geometry, descriptive geometry, chemistry, mechanics, physics, theory and practice of weaving, spinning, accounting, firing, steam engine tending, history of ornamentation, and electricity; in French—chemistry, chemical manipulations, mechanics, physics, accounting, industrial economy, and steam engineering. English and German are also taught.

In addition to the above branches and special subjects, drawing receives prominent notice. The drawing courses include elementary drawing of various degrees, mechanical drawing, drawing as applied to construction, and ornamental drawing and modeling.

The lessons are given, for the most part, from 5 to 9 o'clock in the evening, though instruction in certain courses is given during the day and on Sunday morning. Following are the tuition fees paid by students: Ten francs ($1.93) a year for each independent registration in branches for which charges are made; 10 francs ($1.93) a year for regular students in the courses relating to the mechanical and chemical industries; 100 francs ($19.30) for regular students in the textile industry course; 200 francs ($38.60) for special students attending only the practical exercises in the weaving shop; 30 francs ($5.79) for regular students in the decorative art course, and 50 francs ($9.65) for special students attending the decorative art course.

The school is well equipped for its work. It has a library, a chemical laboratory, a physical laboratory, an electrical workshop, a weaving workshop, and collections of appliances and industrial materials.

The building is ample for its purposes. In 1895–96 there were 918 students following the various courses. These were classified according to ages and occupations as follows: Four hundred and forty-eight from 14 to 16 years of age, 255 from 16 to 20 years of age, and 215 20 years of age or over; 456 were workingmen, 218 were office employees, 206 were students in various schools, and 38 were without occupation.

INDUSTRIAL SCHOOL, JUMET.

This institution, sometimes called the "School of industry and design," and sometimes the "Industrial and commercial school," was established the last day of December, 1870, and was reorganized in 1894. It is a mixed school, including industrial departments, a commercial department, and a department of artistic designing. The latter does not alter its character as an industrial school, as the drawing is in reference to industry.

Formerly there was a lack of unity in the instruction, the student being allowed too much liberty in selecting studies, to the detriment of himself and the school. Again, the proper degree of primary education was not always exacted of pupils. That condition of affairs has been changed by the new organic law, and the school may now be said to have a prosperous future before it. More attention is paid to the qualifications of matriculants, who are now required to follow regular series of studies in relation to their trade or occupation, and none are allowed to enter the specialized departments without being suitably prepared. The reforms caused a temporary decrease in attendance, but the loss has been more than recovered and the prestige of the school has increased.

As the school is now organized the programme of instruction includes a preparatory course of two years, common to all students, and two other years of study in one or more of the following special courses or departments: (1) A course for draftsmen; (2) a course for machinists; (3) a course for miners; (4) a course for constructors; (5) a course for clerks, office employees, etc. (commercial course).

The various branches and specialties in which instruction is given are arithmetic, hygiene, French, geometry, drawing of various degrees (elementary, projections, etc.), drawing applied to industry, physics, chemistry, algebra, trigonometry, surveying, commerce, German, English, industrial economy, mechanics, steam firing and engine tending, shop technology, exploitation of mines, and building construction. A course in practical electricity was installed in 1898. Drawing has been reorganized by taking as a basis the teaching of geometric forms and projections. Industrial economy is an obligatory branch for all third-year students.

The school year lasts from October 1 to July 10. Instruction is

given evenings from 7 to 9 o'clock, and on Sunday morning from 7.45 to 11.45. Four years of study are required of students in both Sunday and evening courses. The entrance fee is 3 francs ($0.58) for residents of the commune and 5 francs ($0.97) for nonresidents. Students on entering must be 14 years of age, as a general rule, and must have a knowledge of the fundamental rules of arithmetic.

Including the director there are 15 instructors engaged in the various courses.

The number of students enrolled in 1895–96 was 326. The following table shows the enrollment for each of the four school years following that date. The students are separated as to evening and Sunday attendance, and as to age groups. Another column shows the per cent of decrease in attendance by the end of the year. The large decrease (29 per cent) shown during the last year of the period is partly attributable to increased industrial activity, which took many from the school.

NUMBER OF STUDENTS ENROLLED, BY AGE PERIODS, AND DECREASE IN ATTENDANCE, INDUSTRIAL SCHOOL AT JUMET, 1896–97 TO 1899–1900.

School year.	Students enrolled in—			Total students.	Age of students.					Decrease by end of year (per cent).
	Evening classes.	Sunday classes.	Evening and Sunday classes.		12 and under 14 years.	14 and under 16 years.	16 and under 18 years.	18 and under 20 years.	20 years or over.	
1896–97	75	158	175	408	.....	120	102	76	110	24
1897–98	75	175	178	428	.....	114	116	71	127	25
1898–99	92	241	218	551	.....	129	163	99	160	21
1899–1900	86	248	191	525	8	114	126	123	154	29

The following table shows in a general way the character of the employment of the students enrolled during each of the four years 1896–97 to 1899–1900:

CHARACTER OF EMPLOYMENT OF STUDENTS, INDUSTRIAL SCHOOL AT JUMET, 1896–97 TO 1899–1900.

School year.	Total students.	Character of employment.					
		Mine employees.	Employees in industrial establishments, trades, etc.	Agriculture.	Clerks, office employees, etc.	Various other employments.	Students in other schools.
1896–97	408	15	183	6	86	66	52
1897–98	428	20	193	3	113	60	39
1898–99	551	27	266	2	139	66	51
1899–1900	525	24	238	4	152	55	52

A large number of prizes consisting of tools, instruments of precision, text-books, and savings-bank accounts are awarded each year to the best students. Numerous prizes are offered by manufacturers and others who wish to encourage the students.

An association of the alumni has recently been formed. It numbers over 130 members and is active in devising means for the betterment of its members and for assisting the school.

This institution ranks high among industrial schools, not only in attendance, but in the character of the instruction and the intelligence of the students.

INDUSTRIAL SCHOOL, LA LOUVIÈRE.

The school at La Louvière was established in 1888 by the commune, assisted by the province of Hainaut and the State, and was opened to students in October of the same year. Its object is explained to be the proper preparation of workmen for performing in a worthy manner the duties of foremen, overseers, etc., in the various industries of the neighborhood. While this school was compelled to begin in a very modest way, there being a lack of many essentials in the way of furniture, apparatus, etc., it is now very well supplied with models and scientific objects for illustrative purposes, and has a modest library. It occupies the intermediate school buildings.

The instruction is given in two divisions, one for evenings and the other for Sundays. Those departments in which Sunday instruction is given are: (1) The department of mining; (2) the department for firemen and enginemen; and (3) the department for artisans (masons, carpenters, and joiners). Instruction in these Sunday departments is given during the hours from 8.30 a. m. to 12.30 p. m.

The evening departments are: (1) Department for accountants, clerks, salaried employees, etc. (commercial department); (2) department for firemen and enginemen; (3) department of metallurgy; and (4) department for earthenware and glassware workers. In these departments instruction is given on four week days from 7 to 9 p. m. Besides these regular departments there are special courses which are optional. The subjects and specialties taught in the school are arithmetic, geometry, trigonometry and surveying, French, bookkeeping, commercial law, industrial geography, physics, chemistry, shop technology, application of descriptive geometry, building and industrial construction, exploitation of mines, general and industrial drawing, ornamental drawing from casts, industrial economy, hygiene, German, English, and painting on china and porcelain.

In 1897 the course in surveying was enlarged by adding instruction in the strength of materials, the elements of leveling, and the construction of roads, sewers, etc., thus forming a new department entitled "Department for conductors of works." A course in practical electricity was added in 1898 and a laboratory installed in connection therewith.

The age of admission is 14 years, but those having received a certificate from the primary schools may be admitted before they reach the age of 14. Females are admitted to the commercial classes

and the painting courses. An admission fee of 3 francs ($0.58) is charged the students living in the commune, but nonresidents must pay 5 francs ($0.97). No tuition fee proper is charged.

The school year extends from October 1 to August 1. The duration of study is three years in all week-day courses. It is also the same for all Sunday courses except the commercial course for females and the German and English courses, in which it is two years.

A large number of cash prizes are distributed every year in sums ranging from 7.50 francs ($1.45) to 25 francs ($4.83). Several special prizes are offered by societies, establishments, and individuals. Other prizes consisting of books and instruments are given in large numbers for assiduity and ability shown. A feature of the school is the plan of offering a special reward to graduates who receive additional diplomas. The result may be judged from the fact that in 1900 prizes were awarded to 33 students for obtaining a second diploma, to 19 for a third, to 5 for a fourth, to 2 for a fifth, and to 1 student for having obtained a sixth diploma. In the preceding year one student was rewarded for having obtained a seventh diploma.

Visits to industrial establishments for the purpose of observation and study are made by the various departments. This custom, which is supposed to be followed in all industrial schools, is more closely observed in this than in many others.

The La Louvière school is of growing importance. During the first year of its existence there were 223 students enrolled, while during the school year 1899–1900 the number amounted to 801, of whom 84 were females. The students came from about 50 communes.

The following table shows for each school year from 1896–97 to 1899–1900, the enrollment in the evening and Sunday divisions, and the total enrollment, the number of students, by age periods, the number and per cent of decrease in attendance by the end of the year, and the number of diplomas granted:

NUMBER OF STUDENTS, BY AGE PERIODS, DECREASE IN ATTENDANCE, AND DIPLOMAS GRANTED, INDUSTRIAL SCHOOL AT LA LOUVIÈRE, 1896–97 TO 1899–1900.

School year.	Students enrolled in—		Total enrollment.	Age of students.					Decrease by end of year.		Diplomas granted.
	Evening courses.	Sunday courses.		12 and under 14 years.	14 and under 16 years.	16 and under 18 years.	18 and under 20 years.	20 years or over.	Number.	Per cent.	
1896–97.....	218	338	556	73	133	123	80	147	119	21	59
1897–98.....	248	402	650	84	177	152	84	153	157	24	107
1898–99.....	287	481	768	92	194	181	128	173	176	23	114
1899–1900...	259	542	801	43	155	209	158	236	(a)	23	124

a Not reported.

The principal points to be illustrated by this table are the steady increase in attendance and the ages of the students. As regards this latter point, it is surprising to note that nearly one-half the students enrolled in 1899–1900 were 18 years of age or over, while three-fourths

of them were 16 years or over. This is another proof that the actual workmen are most interested in the industrial schools. Of the 124 diplomas granted during the same year there were 4 in mining, 29 for firemen, enginemen, etc., 10 in building construction, 8 in shop technology, 4 in metallurgy, 8 in electricity, 15 for conductors of works, 5 for painting in imitation of wood and marble, 19 in commerce, 17 in foreign languages, and 5 in painting.

The following table shows for each year of the same period the number of students, subdivided as to sex and character of employment:

NUMBER AND CHARACTER OF EMPLOYMENT OF STUDENTS, INDUSTRIAL SCHOOL AT LA LOUVIÈRE, 1896-97 TO 1899-1900.

School year.	Students enrolled.		Total enrollment.	Character of employment.					
	Males.	Females.		Mine employees.	Employees in industrial establishments, trades, etc.	Salaried officials and clerks.	Agricultural occupations.	Various other gainful occupations.	Students in other schools.
1896-97	481	75	556	18	300	68	3	95	72
1897-98	548	102	650	14	358	92	2	95	89
1898-99	660	108	768	11	395	108	3	148	103
1899-1900	717	84	801	12	413	124	5	148	99

This table but emphasizes the fact that by far the greater proportion of students are those already engaged in industrial or other occupations, and hence have not the time to attend schools except those of this character.

INDUSTRIAL SCHOOL, MORLANWELZ.

The official report on technical education in Belgium published in 1897 begins the account of the Morlanwelz school with the following paragraph: "The industrial school of Morlanwelz occupies, by its organization, its school population, its magnificent equipment, the excellence of its instruction, and its model corps of teachers, the foremost rank among similar institutions of the country."

The origin of this school was found in the modest school of drawing established in 1866 under the auspices of M. Léon Warocqué, administrator of the Mariemont and Bascoup collieries and mayor of Morlanwelz. Lessons were given on Sunday morning from 9 to 12 o'clock in the attic of the boys' primary school. In 1871 Mr. Arthur Warocqué, who had succeeded his brother as director of the school, proposed that its scope be broadened by the addition of other courses. This proposition was favorably received by the communal council of Morlanwelz, and on May 26 of the same year the school was converted into an industrial school, and from that date it has steadily developed. The attendance so increased that it was necessary to use the recitation rooms of the primary school. This space in time became insufficient,

and a separate building, especially designed for the use of the industrial school, was erected in 1888. Additions became necessary and were made in 1894.

At first instruction was given on certain nights during the week. In 1873, however, a Sunday division was added for those who could not attend the evening classes. New courses have been added in both the evening and Sunday divisions as necessity demanded. Courses in hygiene and industrial economy, common to certain students of both divisions, were added in 1878; a course in commerce was added to the evening division in 1882, and one in free-hand industrial drawing was added to the Sunday division in 1883. The last course was transformed into the department of shop technology in 1892. The department of building constructions was added in 1887 and that of industrial electricity was founded in 1893. Thus in its present organization the school consists of two divisions, the one embracing courses given on Sunday and the other courses given on week-day evenings.

The Sunday division embraces five departments, relating to as many branches of industry. The duration of studies in the Sunday departments is three years for some and four years for others. During the first two years the students of all the departments pursue the same studies: Arithmetic, practical geometry, drawing, projections, sketches, etc. Specialization takes place in the third year among the following five departments: Department of mining (in this the students study the exploitation of mines, dialing, and apparatus made use of in mining work); department of building construction (in this are given courses relating to materials that enter into buildings and their employment, the drawing of simple constructions and their parts, and the maintenance of buildings); department for firemen and enginemen (this includes the study of the elements of physics and mechanics, boilers, steam engines, their care and maintenance, and the drawing of the parts of which they are composed); department of shop technology (in this instruction is given in physics and mechanics so far as necessary in the study of metals, hand and machine tools, and the setting up and care of machinery and metallic constructions; also the drawing of tools and machines and their parts); department of industrial electricity (in this are studied the principles of industrial electricity, the ordinary apparatus and methods employed in generating electrical currents, the utilization of these currents, and the drawing of all apparatus and their parts). To be admitted to the last department students must have a knowledge of physics and mechanics. In fact, physics and mechanics applicable to the particular subjects form the stepping-stone from the second year to the last three specialties. The departments for mining and civil constructions require one year in addition to the preparatory course of two years. The departments for firemen and enginemen and for shop technology require two

additional years. The department for industrial electricity has heretofore required but one extra year, but another year is to be added, making the time four years.

In all the Sunday departments the study of hygiene and industrial economy is obligatory, but only twelve hours during the year are devoted to these subjects. All of these Sunday courses are given in the morning from 7.15 to 10.15 during the summer months and from 8.15 to 11.15 during the winter months.

The evening division embraces two departments, one of which is preparatory to the other. The complete course, including all the studies in both departments, is covered in five years. The first three years are passed in a department for draftsmen, which carries the following studies: Arithmetic, algebra, elementary geometry, applied geometry, surveying, leveling, descriptive geometry, commerce, industrial economy, hygiene, and industrial drawing. The next two years are passed in a department of mechanical engineering, which includes the study of physics (gravity, heat, light, electricity), physics applied to heating and steam generating, elementary chemistry, mechanics, strength of materials, metallic constructions, workshop technology, steam engines and boilers, the drawing of boilers, engines, and metallic constructions.

In the evening division instruction is given on Tuesday, Wednesday, Friday, and Saturday from 7.15 to 9.30 o'clock, and it is much more complete than in the Sunday division. It is very usual, however, for students who have completed the studies in the evening division to follow one or more of the specialized departments of the Sunday division. They most frequently enter the departments of mining, building construction, and industrial electricity. It is proposed to reward such students in the future by giving them a higher diploma at the end of the course than is given to the ordinary student of the Sunday division. At the same time they will be subjected to a more rigid examination, and the instruction will be on lines to agree with their more advanced technical knowledge.

The school year begins October 1 and covers a period of 40 weeks. The school term thus includes 120 hours of recitations for the Sunday courses and 360 hours for the evening courses. In 1900 the school possessed a corps of 18 teachers, the director included, many of whom were engineers by training or members of the technical force of large industrial establishments of the neighborhood.

The minimum age of admission of students is 14 years. Those who have completed their primary education, however, can enter regardless of their age. Since 1886 girls have been admitted to all the courses, but there were only 6 girl students in 1896 and in 1900 there were only 13. The students must furnish at their own expense all materials of which they have need. Instruction is gratuitous, with the exception

that residents of Morlanwelz pay an entrance fee of 3 francs ($0.58) and nonresidents 6 francs ($1.16). Each student must be provided with a manual for each course. Elaborate note taking is discouraged. The principal industrial establishments of the surrounding districts are visited by the students each year under the direction of a competent instructor. The students are required to make a great many drawings and plans each year, and, to a less extent, models.

The growth in importance of the school can best be traced in the increase that has taken place in the number of students in attendance. Several months after the opening of the courses in 1871 there were but 50 students. By the end of the year the number had increased to 150. There were 200 in 1876 and 708 in 1893. In this latter year the admission fee was raised and the number decreased somewhat, being but 647 in 1896, the last year included in the Government report. The school report for 1900 states that 776 students were enrolled during the school year 1899-1900. Of these 272 were students entering for the first time, or after an absence of several years, while 504 had attended during the previous year. The total number enrolled in 1900-01 was 811, of whom 627 were in attendance at the end of the year.

Comparative figures showing the grouping of students by age periods for the school years 1896–97 to 1899-1900 are here introduced in tabular form. The data for 1900–01 are not complete and can not be used in this comparison.

NUMBER OF STUDENTS, BY AGE GROUPS, INDUSTRIAL SCHOOL AT MORLANWELZ, 1896-97 TO 1899-1900.

Year.	Students enrolled during year.	Students in attendance at the end of the year.	Ages of students enrolled.				
			Under 14 years.	14 and under 16 years.	16 and under 18 years.	18 and under 20 years.	20 years or over.
1896–97	702	579	46	235	155	103	163
1897–98	728	602	54	157	227	132	158
1898–99	733	568	97	157	178	101	200
1899–1900	776	613	90	181	178	125	202

The occupations of those entering the school in 1899–1900 and the distribution of the pupils among the various sections are shown in the following table:

NUMBER OF STUDENTS, BY OCCUPATIONS AND INDUSTRIES, INDUSTRIAL SCHOOL AT MORLANWELZ, 1899–1900.

Occupations and industries.	Total students.	Sunday division.							Evening division.	
		Students not specialized.		Third-year students in department for—					Department for draftsmen (first 3 years).	Department of mechanical engineering (last 2 years).
		First year.	Sec'nd year.	Mining.	Firemen and engineers.	Building construction.	Shop technology.	Electricity.		
MINING.										
Miners	133	61	34	25		10			3	
Lamp keepers	14	3	4		3		2	1	1	
Sorters, washers, etc	13	4	4	1	2	2				
Taggers, markers, etc	7	2			2		1		2	
Other mine employees	5	2	2							1
FOUNDRIES, MACHINE SHOPS, ETC.										
Blacksmiths and helpers	41	18	11		3		3		3	
Boiler makers	12	3	4		1	1			3	
Pattern makers	14	4	4		2		2		2	
Molders	19	11	4		1		2		1	
Sketchers	46	10	3		6	1	10	2	12	2
Fitters, setters-up, etc	53	10	14		8		6	3	10	2
Turners and planers	39	11	13		2		5	2	4	2
Thread cutters	30	13	12		1				4	
Firemen	18	5	2		5		3	2	1	
Enginemen	4	1	1					2		
Oilers	5	3	1		1					
Others	14	6			3		1	1	2	1
BUILDING TRADES.										
Excavators	2	1	1							
Masons and marble workers	8	2				3			3	
Plasterers	3	2				1				
Carpenters and joiners	43	11	7			10	1		13	1
Housesmiths	3	2			1					
Painters	1								1	
Other building employees	2	1	1							
SALARIED EMPLOYEES AND MISCELLANEOUS OCCUPATIONS.										
Draftsmen	20			2		1	1	1	7	8
Shop clerks	3	1							2	
Inspectors of works	1								1	
Foremen, overseers, etc	2	1						1		
Bakers	2								2	
Gardeners	3				1	1			1	
Shoemakers	3	2							1	
Tailors	8	1	2						5	
Wheelwrights	1	1								
Photographic printers	2		1							1
Messengers	14	6	3					1	4	
Day laborers	31	6	12	2	2		4		5	
Miscellaneous	59	7	5	2	2	6	2	6	21	8
No occupation	21	5	2			1		1	12	
Pupils in other schools	77	35	10			2	1		29	
Total	776	251	160	32	46	39	44	23	155	26

The first of these tables shows the interesting fact that a large percentage of those who attend this school are above the age at which the usual school studies are terminated, and the number of such students is increasing. Taking those above 18 years of age, for instance, it is

seen that an actual as well as a relative increase has been shown from year to year. In 1896–97 there were 266 students 18 years of age or over, or 37.9 per cent of the total enrollment; in 1897–98 the figures were 290, or 39.8 per cent; in 1898–99 they were 301, or 41.1 per cent; and in 1899–1900 they had risen to 327, or 42.1 per cent.

The second table shows that with the exception of 98 all the students were engaged in gainful occupations, only 77 being reported as attending other schools. It is interesting to note the large number of students drawn from the mining, building, and foundry and machine-shop industries, which are represented in the Sunday division of the instruction by the departments for mining, building construction, and shop technology.

As usual in schools of this character, quite a large percentage of the students drop out before the end of the year. This defection amounted to 21.5 per cent for the school year ending July 30, 1901, 21 per cent in 1900, 22.5 per cent in 1899, 17.3 per cent in 1898, and 17.5 per cent in 1897. This is probably no greater than the average defection in industrial schools.

Certificates of proficiency are awarded to those who pass a successful examination at the termination of their studies. Great value is placed upon them both by the student and his employer. The first certificates were delivered in 1874 to 13 students who had completed the work in the department for designing. From that date until 1901 a total of 1,168 certificates had been granted. The number of individuals receiving them was not reported, but in the general report issued in 1896 by the Belgian Government it is stated that at that date 832 certificates had been issued to 492 students, thus indicating how frequently the same student follows the studies in more than one department. The following statement shows the distribution of the 1,168 certificates among the different departments:

Sunday courses:	
Department of mining (since 1877)	228
Department for firemen and enginemen (since 1881)	263
Department of building construction (since 1888)	171
Department of shop technology (since 1893)	86
Department of industrial electricity (since 1894)	64
Week-day courses:	
Department for draftsmen (since 1874)	243
Department of mechanical engineering (since 1876)	113
Total for both courses	1,168

Of the 492 students who had received certificates at the end of 1896 the occupations on entering the school and those subsequently engaged in are shown in the following table:

OCCUPATIONS OF STUDENTS ON ENTERING SCHOOL AND SUBSEQUENTLY, INDUSTRIAL SCHOOL AT MORLANWELZ.

Occupations.	On entering school.	Subsequently.	Occupations.	On entering school.	Subsequently.
Students	165	5	Chief engineers		4
Day laborers	14	4	Office employees	23	121
Miners	126	46	Foremen of shops, draftsmen, and builders	5	63
Shop workmen	91	80	Engineers and heads of establishments		13
Building workers	15	20			
Firemen and enginemen	14	28			
Various trades	33	28			
Overseers	4	18	Total	492	492
Foremen, mines	2	56			
Chief foremen, mines; directors of works		6			

This must be considered as in every respect a remarkably favorable showing. It is noticeable that fewer persons are engaged in the lower occupations after leaving than upon entering the school, while in the higher occupations the opposite result is seen. The class of miners shows the extent to which students have been enabled to improve their conditions as the result of the training received in the schools. The list shows that 126 miners entered the school, while but 46 are found in that occupation subsequently. On the other hand, there are shown 56 mine foremen and 6 chief mine foremen against but 2 holding those positions upon entering the school. In the same way while there were but 5 foremen of shops, draftsmen, and builders entering the school 63 attained this position in subsequent years. Similar comparison could be made for other classes of the occupations shown.

Excursions for observation are made, each department visiting such industrial establishments as present features of interest in line with their studies. Thirty-five such visits were made in 1899–1900.

Some traveling scholarships are accorded the best students each year. Those receiving them are required to send a written report of their observations to the school. This school has become such an important institution that the provincial inspector, after suggesting numerous changes, in his report for 1900 recommended that the administrative commission solicit authority from the State and province to change its title to "superior school."

Subsidies are received from the State, the province of Hainaut, and some of the neighboring communes. Expenditures are not high, considering the importance of the school. The total cost for 1896 was 20,806 francs ($4,016). The cost for 1899 was 24,604 francs ($4,749).

The school is governed by an administrative commission composed of 6 members, of whom 2 are named by the State, 2 by the province of Hainaut, and 2 by the communal authorities. The immediate control is vested in a director.

INDUSTRIAL SCHOOL, SERAING.

Another school for which data of a later date than 1896 could not be obtained, but which should be mentioned because of its importance, is that of Seraing. This school was founded in 1858 by the commune and several heads of industrial establishments for the purpose of so enlarging the knowledge of workingmen as to enable them to exercise their vocations in a more intelligent manner. The school from its origin was subsidized by the Government, but was not regularly recognized as a subsidized institution until 1861. Several unimportant changes were made in the organic law from time to time, but it was not until 1892 that the present organization was adopted. Previous to that year regular students were required to attend four years and study all the branches then taught. Upon passing the prescribed examination they received a general diploma, in which no specialty was mentioned. Under that system special students were admitted and allowed to choose such studies as they pleased, which was more often a detriment than otherwise, for such students often chose with little wisdom and were after a time discouraged and became irregular in attendance or dropped out altogether. The reorganization of 1892, however, completely changed the old system, and with beneficial results. No special students are now admitted. The duration of studies is four years, as before, but the scheme of instruction includes two distinct divisions, namely: (1) A preparatory department, in which all the branches taught are obligatory and in which three years of study are required; (2) a special department, in which the student may devote his time to a specialty. In this department one year's attendance is required.

The preparatory department includes instruction in French, linear drawing, ornamental drawing, industrial drawing, arithmetic, algebra, geometry, plane trigonometry, descriptive geometry, physics, mechanics, chemistry, hygiene, industrial economy, and commerce. The special subjects taken up in the fourth year are (1) industrial chemistry and metallurgy, (2) applied mechanics, the construction of machinery, and firing of boilers, (3) building construction, (4) practical electricity, (5) geometric drawing, sketches, and their application.

A special Sunday course in linear drawing, ornamental drawing, and industrial drawing is annexed to the school. Diplomas are now issued in the first four specialties shown above instead of the general certificates formerly awarded. During the fourth year the students visit industrial establishments under the guidance of their respective teachers. There they witness the various metallurgical operations, draw diagrams of machinery in motion, become better acquainted with the various parts of machinery, and learn a multitude of practical details which it would be difficult to explain in the class room.

The school year begins October 1 and ends the last of June. The class hours are from 7 to 9 p. m. on week days and from 9 to 11 a. m. for the Sunday drawing course.

To be admitted, students must be 14 years of age and submit to an examination in French and arithmetic. In the Sunday course, however, students are admitted at 12 years of age. The latter course is free. Tuition is also free in the week-day courses for students living in Seraing, but nonresidents are required to pay 20 francs ($3.86) per year.

This school occupies the building of the intermediate school. During 1895–96 there were 375 students enrolled. During the same year 33 diplomas were delivered in the specialties mentioned above. The institution is said to be doing good work. Eighteen instructors, the director included, are employed.

INDUSTRIAL SCHOOL, TOURNAY.

The industrial school at Tournay is one of the oldest and most important industrial schools in Belgium. In 1837 the communal council created a school of arts and trades. The civil hospitals, the bureau of charity, and two individuals contributed 52,000 francs ($10,036) toward the cost of installation, which amounted to 127,000 francs ($24,511). In 1860 the school was thoroughly reorganized, in order to bring it more in touch with actual industrial conditions, and it now has a scheme of operation that is possessed by no other industrial school in Belgium. Its work is divided between two distinct divisions: (1) The industrial school proper and (2) apprenticeship workshops, in which instruction is given during the day. There is also a boarding department under the supervision of the director of the school, which permits students from other districts to take advantage of the school. To be admitted to the boarding department students must be between the ages of 14 and 16 years. Instruction is gratuitous for all students, but 450 francs ($86.85) a year is charged for the privileges of the boarding department.

This organization would seem to resemble that of the trade schools, but differs from them in some respects. Thus all students in the industrial school are not expected to serve in the shops, and for those in the shops (apprentices) attendance in the industrial school is only obligatory for the boarding students. Were it otherwise, this would be very properly considered a trade school.

The school and workshops are governed by a commission of 9 members, of which 6 are appointed by the communal and 3 by the provincial authorities. The school grants 3 kinds of certificates: (1) Certificates of theoretical studies given to students of the third year who have passed the prescribed examination successfully; (2) certificates of practical studies to apprentices satisfactorily completing their appren-

ticeship in the shops, and (3) certificates of theoretical and practical studies to students who have completed both courses.

The school is excellently housed in a large building and is fully equipped with the necessary tools, collections, models, books, etc., for its work.

In the industrial school the instruction covers three years and includes the study of French, arithmetic, geometry, mechanics, chemistry, physics, calculations, theoretical and practical electricity, industrial economy, and drawing. The course in applied electricity was opened in 1895. The lessons are given from 7 to 9 in the evening during the winter months and from 6.30 to 8.30 in the morning during the summer months. The course in industrial and practical electricity is given on Mondays and Saturdays from 4.30 to 6 p. m. To be admitted students must be 12 years of age or over and have completed their primary education. In 1899–1900 these courses were attended by 200 students, most of whom belonged to the laboring classes.

Much the most interesting and important feature of the school of Tournay, however, is the division of apprenticeship workshops. In 1900 the school had 6 classes of shops, in which were employed a total of 121 apprentices, as follows: Machine shops, 37; iron-turning shops, 20; joinery shops, 18; pattern-making shops, 16; locksmithing shops, 25; molding shops, 5.

The school has no shops of its own. It enters into contracts with local manufacturers, who undertake to direct the pupils' practical education under conditions set forth in the contracts. At present there are three such contracts in force. Some of the main features of these contracts are as follows:

1. The Tournay Construction Company undertakes to receive 80 apprentices into its shops, of whom 36 are to be placed in the machine shop, 16 in the iron-turning shop, 14 in the molding shop, and 14 in the pattern-making shop. The company furnishes shop room and machinery. It also furnishes tools for the machinists' and turners' apprentices, but the molders' and pattern-makers' apprentices furnish their own tools. These apprentices do not receive any remuneration, but the company must distribute 500 francs ($96.50) a year as prizes to the most meritorious. One thousand francs ($193) was paid by the school for shop room and tools placed at the disposition of the apprentices, and in addition the company receives 1,500 francs ($290) annually for the instruction given.

2. M. Henri Vanden Broeck, ironmonger, undertakes to admit 18 apprentices into his shops and to make them good locksmiths, sheet-iron workers, or wrought-iron workers. The apprentices are to be admitted on six months' probation, then definitely if they show aptitude. They receive nothing for their work during the first two years,

but during the next two years they are paid a daily wage of 0.50 franc ($0.10) for the first 6 months, 0.60 franc ($0.12) for the second 6 months, 0.70 franc ($0.14) for the third 6 months, and 0.80 franc ($0.15) for the fourth 6 months. The contractor furnishes all tools, machinery, rooms, etc., for the apprentices and receives 1,000 francs ($193) a year if the number of apprentices is 9 or more and 500 francs ($96.50) a year if the number falls below 9.

3. The third contract has essentially the same terms as the second. It is between the school and a firm of master joiners, who agree to receive 18 apprentices in joinery work. Those who contract to receive apprentices agree to observe proper rules as regards hours of labor, character of work given to the apprentices, etc. They also agree to give as much time as possible to the supervision of the apprentices and to employ competent foremen to give instruction during their absence. They agree to arbitrate disputes which may arise between themselves and the administrative commission of the school. They also agree to observe rules formulated by the school for the government of the shops. The apprentices work from 9 to 12 in the morning and from 1 to 6 in the afternoon, with an intermission of 30 minutes at 4 o'clock.

This system of the apprentices working under contract for a manufacturer is a unique method of combining technical instruction with the practical work of trades, and has given excellent results.

Former contracts were much more liberal as regards remuneration of apprentices than the present ones. Those in force in 1896 specified that payment was to begin with the second year and the amount was to be increased each quarter. All the apprentices then received payments, beginning with 0.10 franc ($0.02) per day the second year and increasing to 0.50 franc ($0.10) at the beginning of the third; 0.85 franc ($0.16) at the beginning of the fourth, and 1.15 francs ($0.22) at the end of the fourth year. Those who served five years (all except the joiners' apprentices) received 1.50 francs ($0.29) at the end of the fifth year.

Applications for admission to the shops are now more numerous than the places provided for in the contracts.

The school is subsidized by the State, province, and commune.

INDUSTRIAL AND TRADE SCHOOL, VERVIERS.

This school owes its origin to the union in 1862 of the school of workmen and artisans, founded in 1837, and the courses of weaving and designing, inaugurated in 1857. A new organic law was promulgated in 1883 and modified in 1894. As at present constituted, the special aim of the school is to give a technical training to workmen in the numerous industries of Verviers. In the scheme of instruction there are two divisions: (1) A preparatory division, common to all the

students, and (2) a superior division, subdivided into three departments. These departments are: A department of mechanics and construction, a department of dyeing, and a department of weaving.

One year is required in the preparatory division and three years in each department of the superior division. The student chooses that department in which the instruction is best adapted to the requirements of his occupation.

The subjects taught in the preparatory division are French, arithmetic, elements of geometry, and drawing. The branches and specialties carried in the three sections of the superior division are geometry, commerce, physics, elementary mechanics, applied mechanics, elements of machinery construction, inorganic and organic chemistry, dyeing (theoretical and practical), the technology of woolen mills, weaving (theoretical and practical), electro-technics, industrial architecture, industrial economy, drawing, and hygiene.

The school year begins October 1 and ends June 30. Instruction is given from 8 to 10 p. m. in all subjects except practical dyeing, which is given on Sunday from 9 a. m. to 12 m.

A small fee of 2 francs ($0.39) is charged each year. Since the establishment, in 1894, of the superior school of textiles, this school has occupied a commodious structure in common with it separate rooms, however, being allotted to each.

A large collection of materials, models, instruments, etc., has been made. This is especially true for the sections relating to the woolen industry and the branch relating to machinery.

The age of admission is 14 years. Candidates for admission must pass an examination or otherwise give proof of their ability to profit by the instruction. The general level of studies has been recently raised by cutting off some courses which were too elementary in character.

During 1895–96, 587 students were enrolled. Of this number 454 were broadly classed as workingmen, 98 were clerks, office employees, etc., and 17 were schoolboys or students. The remaining 18 were without occupation.

In this school the departments relating to the textile industries furnish a preparatory training for workmen who desire to enter the superior textile school. While the latter school was more particularly intended for the sons of manufacturers—that is, for those who are to direct industrial enterprises—it also provides for the training of the more intelligent workmen who wish to qualify for positions of responsibility in textile manufactories. The work in the textile departments is both of a theoretical and practical nature.

The graduates of the school are reported to be much sought after by manufacturers.

TRADE SCHOOLS FOR MALES.

Under this general class of trade schools are included the day trade schools, the trade continuation schools, and the trade schools of fishing.

Day Trade Schools.

Trade schools as a class have already been described. There are certain so-called trade schools in which instruction is given only in the evening or in the evening and on Sunday. Such institutions are intended more particularly for apprentices to the trades taught, and are not meant to teach trades completely as do the day schools. Hence two divisions of the Belgian trade schools are made, one division containing day schools, or trade schools proper, the other containing the evening or evening and Sunday schools, or trade continuation schools. The fishing schools are so unlike the other trade schools that a general description of them is given separately.

Day trade schools may be divided into two subclasses, namely, group schools, or schools for teaching a number of distinct trades, and schools organized for the purpose of teaching one specific trade each. In the H. Nicaise trade school of metal and woodworking at Ghent is found the best type of the group school, while the tailoring schools of Brussels are types of the schools intended for single trades.

H. NICAISE TRADE SCHOOL OF METAL AND WOODWORKING, GHENT.

This school, which is one of the most important of the trade schools of the country, was established by the communal authorities of Ghent in 1887. Its purpose is the training of workmen capable of executing all the higher and finer classes of wood and metal work. It prepares persons for such trades as locksmithing and fine metal working, machine construction, cabinetmaking, joinery, pattern making, turning, etc. As the school seeks to train the higher class of workers, only those students are received who have had a superior primary instruction or an education similar to that offered by the high schools in the United States. Their records in the schools are taken into account in selecting those who may attend this school.

On being admitted, the parents of the students must sign a contract to pay a certain sum if they withdraw their sons before they have completed the third year of their studies. If, on the contrary, the students finish the course, their parents have nothing to pay for their instruction.

As a preparation for the practice of any of the trades taught great attention is given to drawing. Attention is also given to the general cultivation of the students and particularly of their interest in the esthetic side of the handicraft work. The business side of the trades, such as the character and cost of the raw materials made use of, the

preparation of plans, the making of estimates, and the keeping of accounts, is given prominence. Shopwork, however, occupies the major part of the time of the students, the number of hours devoted to this branch of the instruction being gradually increased as the student advances in his course. During the first year the number of hours of shopwork per week is 32, which is increased to 33 in the second year, and to 35 in the third year.

The following table shows the division of the students' time between the general branches and the manual exercises:

HOURS PER WEEK DEVOTED EACH YEAR TO EACH STUDY, H. NICAISE TRADE SCHOOL OF METAL AND WOOD WORKING AT GHENT.

Studies or exercises.	Hours per week.		
	First year.	Second year.	Third year.
French	2½	2½	1
Flemish	3	2½	1½
Arithmetic and geometry	3	2½	1¼
Algebra			1
Accounts			1
Drawing	7½	7½	7
Physics		1	
Mechanics			1
Shopwork	32	33	35
Total	48	49	49

Since its organization the school has undergone considerable enlargement. It now occupies 17,761 square feet of ground. Here are installed its numerous workshops. These include (1) a shop for carpentering, joinery, and cabinetmaking, 157 by 26 feet; (2) a shop for machine fitting and locksmithing, 26 by 54 feet: (3) a shop for metal turning, planing, and fraising, 26 by 54 feet; (4) a shop for forge work, 62 by 26 feet, and (5) a shop for foundry and molding work, 59 by 26 feet. There are also a machinery and motor room, a drawing room, 54 by 26 feet; two class rooms, each 27 by 26 feet, and office rooms. All of the shops are adequately equipped with the necessary tools and appliances.

The instruction is given by a director, 3 teachers for the scientific branches, and 5 foremen for the different workshops. The annual cost of maintenance of the school in 1896 was 28,760 francs ($5,551). Of this something over one-half is borne by the city, the remainder being met by subsidies from the province and State and from other sources. A committee of manufacturers and employers exercises a supervision over the workings of the school, and by means of frequent visits assure that the practical aims of the instruction are never lost sight of.

The following table presents data regarding the number of students each year since the opening of the school, their division into the two departments of iron and wood working, the number leaving the

school, the trades for which those leaving are prepared to enter, and the average daily wages they were able to earn immediately upon beginning work:

NUMBER OF STUDENTS AND NUMBER LEAVING SCHOOL, WITH OCCUPATIONS FOR WHICH PREPARED AND WAGES EARNED IMMEDIATELY THEREAFTER, H. NICAISE TRADE SCHOOL OF METAL AND WOOD WORKING AT GHENT, 1887–88 TO 1896–97.

Year.	Number of students.			Number of students leaving the school	Occupations prepared for.						Average daily wages immediately earned.	
					Ironwork.			Woodwork.				
	Ironwork.	Woodwork.	Total.		Fitters.	Turners.	Blacksmiths	Carpenters.	Pattern makers.	Cabinetmakers.	Ironwork.	Woodwork.
1887–88	14	18	32	.....	.....	.....	.....	.....	.....	.....	.....	.....
1888–89	26	26	52	.....	.....	.....	.....	.....	.....	.....	.....	.....
1889–90	36	36	72	17	6	.....	1	10	.....	.....	$0.34	$0.29
1890–91	51	35	86	22	5	3	2	10	2	.....	.34	.31
1891–92	56	29	85	21	6	2	5	4	3	1	.39	.31
1892–93	59	32	91	22	12	1	3	3	1	2	.39	.31
1893–94	55	27	82	21	12	2	1	3	2	1	.39	.31
1894–95	54	31	85	23	9	3	3	3	3	2	.41	.34
1895–96	34	21	55	17	8	2	1	4	1	1	.42	.34
1896–97	49	18	67	.....	.....	.....	.....	.....	.....	.....	.....	.....

NATIONAL SCHOOL OF WATCHMAKING, FINE MECHANICAL WORK, AND ELECTRICITY, BRUSSELS.

This school is one of the earliest regular trade schools of the country. It was created in 1887 by the watchmakers' association of the city of Brussels. The municipality permitted certain rooms of the Palais du Midi to be occupied for this purpose. During the first few years the school barely maintained its existence, and it was not until 1891, when the Government actively intervened, that the school began its real work.

The school is now administered by a committee consisting of 4 delegates of the State, 1 of the province, 1 of the city, and 2 of the watchmakers' association. The cost of the school, exclusive of the quarters, for which no rent is paid, is about 15,000 francs ($2,895) a year. The number of pupils is about 50. The programme includes four years of study. The limited funds of the school have prevented the creation of all the necessary special courses, and in order to obtain general industrial education the students must attend the courses of the industrial school of the city. Tuition fees are 250 francs ($48.25) a year.

The purpose of this school is very limited. There is no idea of building up the industry of watchmaking in the city, the only effort made being to train workers who can serve as expert repairers in shops for watchmaking, jewelry, and instruments of precision.

TRADE SCHOOL OF FIREARMS MAKING, LIEGE.

Liege is one of the great centers of firearms making in Europe. The methods of production exclusively practiced in times past and extensively pursued at present are those of domestic manufacture.

The different parts of the firearms are to a great extent assembled and the guns finished by the workmen in their own homes. It is only under the stress of foreign competition that factory methods have been introduced to some extent. As a further means of meeting the competition of other lands, there was finally created, after the subject had been repeatedly broached, a trade school in which workmen could receive instruction in those branches which could not well be learned in the shops.

For a number of years prior to 1895 the industrial school at Liege had offered a course on Sunday morning and Tuesday and Thursday evenings on the theory of gun making, or rather the science as applied to this industry. This course included study of the strength of materials, the properties of wood and metal used in guns, the mechanical principles involved in gun making and their uses, etc., and was recognized as performing a very useful service. It was felt, however, that there was need for an institution in which an apprenticeship in both the practice and theory of the trade could be served. The establishment of a school in which this could be done was accordingly decided upon and the cooperation of the Government was accorded in 1895.

The instruction of the school was organized into four departments, corresponding to the different branches of the trade. While it was desirable from some points of view that students should learn all the operations of the trade, from the practical standpoint it was felt to be necessary that the students should specialize according to the branch they intended to enter. The school is well installed and equipped for its work. To be admitted to the school, candidates must be 14 years of age and have completed their primary studies. The school is governed by an administrative commission, composed of nine gun manufacturers, or former gun manufacturers. The hours of work or study are from 8 a. m. to 12 m. and 1 to 6 p. m.

The purpose of this school is to turn out fully-trained workmen. The recent date at which it has been established and the fact that three years are required to complete the course makes it impossible at this time to determine accurately regarding the results that have been attained.

TRADE SCHOOL OF TAILORING, BRUSSELS.

Like almost all trade schools of Belgium, the tailoring school of Brussels owes its establishment to private initiative, but its support has been in part assumed by the central and local governments. Owing to the apparent diminution in the number of skilled tailors, the union of master tailors of the city opened, in a building placed at their disposal by the city, a school for the training of apprentices in the tailoring trade. Operations began with 4 instructors and 15 students. The conditions of admission are that candidates shall be at least 14

years of age, be in possession of a certificate of primary education, and pay an entrance fee of 50 francs ($9.65), and a tuition fee of 12 francs ($2.32) a year.

On the other hand, the students are paid a small sum for the work done by them. This remuneration amounts to 1 franc ($0.19) a week during the first year, 2 francs ($0.39) during the second, 3 francs ($0.58) during the third, and 4 francs ($0.77) during the fourth. These sums are paid into the state savings bank, and remain there in the name of the school until the student shall have completed his apprenticeship. If a student leaves the school before completing his term he loses all right to the sums deposited on his account.

Students on entering must serve a probationary period of one month. If it is seen that they do not have the necessary inclination or aptitude for the trade their entrance fee is returned and they are discharged. If satisfactory, they enter into an engagement to pass four years of apprenticeship at the school.

The courses relate to all branches of tailoring. The greatest advantage enjoyed by the school is the hearty cooperation of many of the important tailoring establishments of the city, which, in addition to contributing to its support, supply the school with work to be done by the students and look after securing positions for the graduates. The expenses of the school are about 12,000 francs ($2,316) a year. No expense is incurred for quarters, as the school is housed in several rooms of the Palais du Midi. The average attendance is about 30. The hours of instruction are from 7 a. m. to 12 m. and from 1.30 to 7 p. m., with intermission for recreation, meals, oral lessons, and gymnastics.

There are 5 teachers and 1 attendant engaged in instructing the students. It is the attendant's duty to take charge of the new students. Each teacher has charge of a class of 5 students for work in the shops. He receives work from a regular patron, and the earnings from the labor of the students form part of his recompense.

Students must draw the different parts of the clothing, and twice a week they receive instruction in the theory of tailoring. An outline of work done during the four years' course is here presented:

First year: Needlework; different stitches; knowledge of yarns, cloths, and linings; straight, cross, and diagonal thread; various kinds of pockets (straight flaps, braided); when to use straight thread; binding edges; various forms of seams.

Second year: Ironing work; shrinking and stretching cloth; sewing together of the different parts of a garment; rules governing smooth, hollow, and padded surfaces; fashions (origin, necessity, forms); sleeves (various forms, etc.).

Third and fourth years: Cutting of cloths, facings, and linings for various kinds of garments; rules for covering hollow and padded places in the linings; trimmings and their necessity; attachment of sleeves; linings for various kinds of coats; theory of collars; sketching or tracing all kinds of collars and their reverse pieces; the three lines of the collar—line of attachment, line of turning, and line of the free edge; covering face of collars with cloth and velvet, and the reverse side with silk; the final ironing, taking off luster, etc.

TRADE SCHOOL OF TAILORING, LIEGE.

In 1888 a trade school of tailoring was organized at Liege under the auspices of the central and communal governments and the merchant tailors of the city. In character this school is similar to that in Brussels. The courses are given every day from 8 a. m. to 12 m. and from 1.30 to 6 p. m. Pupils must be at least 13 years of age and have an elementary education. They must pay an entrance fee of 50 francs ($9.65) and dues of 3 francs ($0.58) quarterly. A committee chosen by the master tailors of the city supervise the work of the school. The workrooms are visited daily by one of the members of this committee.

In this school the boys serve a regular apprenticeship of 3 years. The master tailors give work to the school to be done. There is an attendance of 40. The tailors of the city testify that the school renders very valuable service to the trade.

Trade Continuation Schools.

This subdivision contains a number of institutions whose purpose is not to teach the trade in its entirety but to supplement shop work, which is always more or less specialized, by giving the student the opportunity to gain an insight into all branches of his trade. The instruction is given at night and on Sunday, so as not to interfere with the student's daily occupation. The instruction includes manual work, the same as in the day schools. Some of these night schools give excellent results.

Following the description of certain continuation schools below, a short account is given of the class known as fishing trade schools.

TRADE SCHOOL OF JEWELRY WORKING AND CHASING, BRUSSELS.

In 1894 the trade association of working jewelers decided upon the creation of a trade school for training apprentices in the trade of jewelry making and metal chasing. This determination was seconded by the city, which placed at the disposal of the association for this purpose one of the rooms of the old Palais du Midi, a building originally erected for exposition purposes. At the same time the Government promised to bear two-fifths of the expense. The school was accordingly opened in 1895, since which time it has been in successful operation.

The school is managed by a commission selected from among the most competent members of the jewelers' association. The courses are divided into two departments. In both the main purpose is to cultivate an ability on the part of the student to perform artistic work. In the first, or preparatory department, the student spends a great

deal of time in drawing and modeling. In every case each article must be drawn before it is modeled. In the second department the students do not have to draw after models, but may make their own designs. The entire course covers a period of 4 years. Instruction is given on Wednesday and Friday nights from 8 to 10 o'clock, and Sunday mornings from 9 to 11.30 o'clock.

The outline of work for each of the 4 years is here given.

First year: Linear drawing—exercises tending to develop the ideas of measure and proportion; geometric forms; geometric forms with perspective; drawing from moldings after nature (in geometric forms); copy of ornaments (moldings).

Second year: Drawing from moldings after nature and ornamental subjects; reduction of moldings and ornamental subjects, having in mind their application to trinkets and jewelry; modeling (subjects for ornaments, flowers, etc.).

Third year: Sketching and modeling from nature (flowers, insects, birds, etc.); composition with elements sketched and modeled.

Fourth year: Creation of designs for jewelry and working out the objects designed in brass or lead; esthetics; talks and conferences on subjects relating to the profession; finishing course in metal chasing.

In order to gain admission to the school the boy must be at least 14 years of age, have a satisfactory primary education, and be a working apprentice or workman in the trades of jewelry making, metal chasing, or precious-metal working. Instruction is gratuitous, but an entrance fee of 5 francs ($0.97) is charged. The average attendance has increased from 25 in 1895 to 85 in 1897–98.

TRADE SCHOOL OF PRINTING, BRUSSELS.

In 1886 the Association of Printers of Brussels sent to the heads of all the printing establishments of Brussels and the surrounding suburbs an invitation to attend a meeting to consider the advisability of creating a printing trades school. At this meeting it was determined to seek the cooperation of the two employers' organizations of the city, the Printers and Publishers' Club, and the Trade Association of Printers. Another meeting was accordingly held, at which an agreement for common action on the part of the employers' and the employees' associations was reached. A committee of 8—4 employers and 4 employees—was appointed to elaborate a definite project. This was done in 1887, and, the necessary preliminary steps having been taken, the school was opened in the fall of 1888. The above account of the manner in which this school came into existence is given as an interesting illustration of cooperation on the part of the employers and employees in a trade to create an institution intended for their mutual benefit.

The object of this school is the training of workmen capable of executing all the finer branches of printing. The school possesses accommodations for about 75 pupils. The employers taking part in the maintenance of the school engage themselves to take into their

establishments as printers' apprentices only boys at least 14 years of age, and to limit the number of such in proportion to the number of journeymen employed. Thus those establishments with from 1 to 6 journeymen can have 2 apprentices, those with from 7 to 14, 3 apprentices, and those with from 15 to 25, 4 apprentices. Such apprentices must attend the school regularly. In determining the number of apprentices to which an establishment is entitled, press hands are not counted in the personnel.

Pupils must be at least 14 years of age, be residents of the Brussels district, be able to read and write readily, and be familiar with the fundamental rules of arithmetic. The programme of studies includes courses running for five years. The instruction given is both theoretical and practical. The lessons are given in the evening from 8 to 9.30. There are three sessions per week for each year of studies. Two of these sessions are devoted to the technique of the trade and the third to French grammar. It is obligatory upon the students to attend the sessions in both.

The cost of the school in 1896 was 7,600 francs ($1,467), which is met by the annual dues of the printers patronizing the school, and subsidies by the city, province, and State. The instruction is gratuitous. In order to prevent competition with the commercial establishments, the school is not allowed to execute work for pay.

TRADE SCHOOL OF UPHOLSTERING, DRAPING, TRIMMING, FURNISHING, ETC., BRUSSELS.

This school was established in 1894 through the efforts of members of the trade union of upholsterers and trimmers of the city of Brussels. It was created for the purpose of teaching the trades included in the general terms *tapisserie* (upholstering, paper hanging, draping, etc.) and *garniture* (trimming, furnishing, etc.).

It is not the aim to produce finished workmen or foremen, but so to prepare the students that they may perfect themselves very quickly as all-round workmen in the shops. The advantage claimed for the school over the old shop apprenticeship is the saving in time; for in the shops the work is more or less specialized, and several years would be required to learn all its branches, while in the school all operations are taught during the course, and considerable time is spent on theory and drawing with beneficial results.

The school year lasts from September 15 to May 15. Instruction is given only in the evening. The hours are from 6 to 8 or from 8 to 10, according to the season. Students are admitted between the ages of 14 and 20, those who are already apprenticed to the trade being preferred. They must have finished their primary studies, must be of good conduct and moral character, and must be residents of the province of Brabant. There is no tuition fee, but a matriculation fee

of 10 francs ($1.93) is charged for each year. Students must furnish their own tools, but the school supplies the raw material used. The number of students is limited to about 60, in order to secure the best results with the means at hand, and each year there are more applications for admission than can be accepted. Only the most promising are selected. The number in regular attendance has ranged from 45 to 71, the latter figure representing the attendance during the second year, before the limitation was adopted. In 1901 there were 56 in regular attendance, and the year before there were 62.

Although the school does not claim to produce skilled workmen, it is interesting to note that most of those who finish the courses actually do secure positions either as skilled workmen or foremen, while others become owners of establishments. Those who choose to become journeymen are eagerly sought by employers.

Courses of study are arranged to cover four years. The instruction is divided into two classes—a general course, including theory, which is obligatory for all the students, and trade courses in *tapisserie* and *garniture*, general terms which have been already defined. Less time is given to the general or theoretical than to the practical side of the instruction.

Two hours per week are devoted each year to the general courses and two hours to drawing. The practical work in each of the two departments takes up four hours per week during the first year and two hours during the second, third, and fourth years. The general course includes such subjects as arithmetic, commercial accounts, designing and drawing applied to the trades, theory and harmony of colors, esthetics in furnishings, history of art, etc. The extended outline of work for each year is as follows:

First year: Arithmetic (review of elements, proportion, interest and discount, partnership, and mental arithmetic), orthography and composition (trade correspondence and compositions on subjects relating to the trades), and commerce (so much commercial knowledge as is necessary for the workman or employer).

Second year: Geometric forms, estimation of surfaces, geometric designs, projection, drawing of plans; exercises designed to prepare students for the cutting of stuffs.

Third and fourth years: History of art relating to architecture, building, and furniture, comprehending a study of (1) art of antiquity (Egyptian, Greek, and Roman); (2) art of the Middle Ages (Byzantine and Arabian); art of the eleventh and twelfth centuries (Roman style); art of the thirteenth, fourteenth, and fifteenth centuries (ogival style); and (3) modern art, including the sixteenth century (Renaissance), the seventeenth and eighteenth centuries (Louis XIII, XIV, XV, and XVI), and the nineteenth century (style of the Empire); present style; esthetics in house furnishings, ideas concerning the harmony of colors that should exist in the furniture, drapery, carpets, curtains, paper, seats, etc. (the processes of manufacture and special destination of these articles are studied so that the students may observe certain rules concerning design, perspective, model, light, and color when making a choice of subjects); decoration and furnishing of the vestibule, antechamber, stairway, drawing-room, dining room, bedchamber, dressing room, etc.

On Sundays all the students visit the museums, art collections, expositions, etc.

Two hours a week in each year of study is devoted to drawing relating exclusively to the trades. The outline of work in the trade courses for the separate years follows:

TAPISSERIE (upholstering, paper hanging, draping, etc.).

First year: (1) Tools (description and manner of using, value, production, quality, preservation, and repair); (2) raw materials (description, value, production, quality, and employment); (3) mattresses, bolsters, pillows, eider-down coverlets; (4) different stitches; (5) papers (manufacture, value, and quality); preparation of walls; papering ordinary walls, cloth-covered walls, partition walls, damp walls, cement walls; (6) the hinges on masked doors; (7) wool and hair (description, production, value, quality, employment, preservation, washing, and beating); (8) first lessons in hanging shades and draping curtains.

Second year: (1) Window shades and blinds (different systems, hanging of shades and blinds); (2) curtains for windows (placing the cornice, irons, and rods; draping, washing, and repair of curtains); (3) hanging curtains (undraped); (4) carpetings (source, quality and value; repair, laying, beating, and preservation of); (5) placing of different cloths on walls and woodwork; (6) shopwork (canopies for beds, fancy tables, cushions, etc.); (7) draping of cloths.

Third year: All kinds of work pertaining to decoration and hanging; cutting of curtains, hangings, and draperies; styles (see work in general course); history of upholstery.

Fourth year: Recapitulation of work done during the first three years; original work on the part of the students.

GARNITURE (upholstering, trimming, furnishing, etc.).

First year: Tools (description, use, value, quality, production, preservation, and repair); raw materials (their fabrication, production, use, price, quality, and preservation); art of strapping or cording; springs (their description, manufacture, sources, fashion, and quality); the setting of springs; the cords and rods to be used in hangings around doors and windows; setting and cording down springs (sofas and backs of sofas, etc.); ottomans and footstools.

Second year: Laying heavy cloth; sewing it to springs; trimming packing cases; laying thin cloth; putting nap on cloth; quilting cushions and pads.

Third year: Laying hair and covering it with white cloth; cutting materials; covering furniture (with tapestry cloths, etc.); trimming with lace, etc.; work on upholstered furniture; covering furniture with leather or tapestry; cutting and making covers for furniture; styles (see general course).

Fourth year: See fourth year work for course in *tapisserie*.

Each year the best students are sent on free excursions to places of interest from the trade point of view.

The school is governed by a council composed of 7 members, of whom 2 are employers, 2 are workmen, and 1 each is delegated by the State, the province, and the city of Brussels. Subsidies are received from the State, the province, and from several suburban towns from which students are drawn, but the financial condition of the school has not been encouraging. There has been a deficit at the end of each of its seven years of existence, but the deficits have gradually diminished. In 1901 it amounted to only 126 francs ($24.32) for the year, as against over 4,000 francs ($772) in 1895. The deficits have been met by the founders. The original cost was about 4,000 francs ($772). This was for installation only, as the school rooms are furnished by the city.

The school, when first established, encountered considerable opposition and apathy among both employers and employees.

None of the products of the students' labor are sold. The same material is used over and over.

Trade Schools of Fishing.

The institution of schools for giving instruction in fishing grew out of the desire to do something to improve conditions in the fishing industry, which gave every evidence of losing its former prosperity. It was held that fishermen could ply their trade with greater advantage if they understood such matters as currents, the character of the sea bottom, the reading of marine and weather charts, and the manipulation of improved fishing devices. Much of this information could not be obtained by those who began their practical work at 10 years of age. To supply this want, a beginning was made in 1888 by the creation of a fishing school at Ostend. As the result was satisfactory, similar schools were opened at Blankenberghe in 1890 and at Nieuport in 1893.

Without attempting to enumerate the particular subjects taught, it may be said in a general way that the courses cover the elements of navigation, the management of boats, the making and repairing of nets, lines, and other fishing apparatus, the study of the sea, its currents, bottom, and shores, sounding, operation of the donkey engines, etc., besides general instruction in reading, writing, arithmetic, etc. At the Ostend school there were 97 students in attendance in 1896; at the Blankenberghe school, 83 students, and at the Nieuport school 25, or a total of 205 students in the three schools.

A fourth school has recently been created at Ostend.

SUPERIOR TRADE AND TECHNICAL SCHOOLS.

The purposes of these schools have been explained in the early part of this chapter. In all these schools instruction is given during the day. Of the institutions of this class which properly come within the scope of this report, three give instruction in the brewing industry. The fourth is intended to teach all that pertains to the textile industries. The most important brewing school is fully described in the following pages, while one of the others and the textile school are but briefly considered.

SUPERIOR INSTITUTE OF BREWING, GHENT.

This school was established in 1887 by the Society of Belgian Brewers. Its purpose is to enable brewers and their sons to keep abreast of the progress made in brewing; to afford those not connected with the trade, but who desire to engage therein, an opportunity to acquire the necessary theoretical and practical knowledge of brewing; to give a

course of instruction to brewery foremen and other brewery employees, and to facilitate research in the morphology and physiology of ferments and in other scientific subjects pertaining to the industry. It was at first merely a brewing school, but in 1895 there was added a department for the teaching of distilling, yeast making, etc. All the purposes of the school as outlined in the foregoing text apply equally to the different distilling industries at present.

New branches have been added to the curriculum, and the courses have been extended from time to time, until at present three years of study are required to obtain the highest degree. It is a day school, the lectures and laboratory work occupying two whole days a week in the case of first-year students and three days a week during the second and third years.

Instruction is given in two divisions—a free division and a division in which tuition is charged. The free division is designed for foremen and employees and comprises theoretical instruction in the raw materials and their successive transformations in brewing, the study of brewery apparatus and of steam engines and boilers, and practical work under the supervision of competent instructors. In this division the theoretical instruction occupies only two hours each Sunday, and is given alternately in French and Flemish. This arrangement allows the brewery employees using either language to attend every other Sunday, or about forty hours each term. Visits to breweries are made from time to time and the various operations are explained. The course begins the second Sunday in October. Certificates of attendance are issued to those who attend regularly.

The division in which tuition is charged is the more important. It is intended for those who wish to obtain a thorough knowledge of the brewing and distilling industries, and its courses lead to degrees. There are two courses, known as the trade course, which requires 2 years, and the superior course, which requires 3 years of study. In each course the first year's work leads to the degree of master brewer or distiller and the second year to that of licentiate brewer or distiller. The third year in the superior course leads to the degree known as engineer of fermentation industries, to obtain which degree students must first secure that of licentiate brewer or distiller.

The study required of the classes in brewing and distilling is so similar that much of the instruction in both industries is given in common. The differentiation occurs in the amount and character of the practical work done, and the special attention given to certain branches relating particularly either to the brewing or to the distilling business, that is, the technology of the different apparatus used, the legislation concerning each, the particular fermentation required in each, etc. This difference is true only in so far as the first 2 years' work is concerned, when the student is striving for the licentiate

degree in one particular industry. If he desires subsequently to become an engineer of fermentation industries he must perfect himself in those branches relating to the other industry to which he gave less attention during the first 2 years.

Students must be at least 16 years of age. No entrance examination is required except in the case of those entering the superior course leading to the degree of engineer of fermentation industries. These latter students must obtain an average of 50 per cent in an examination in modern geography, ancient and modern history, arithmetic, algebra, geometry, trigonometry, and letter writing. They must also at the end of the second year obtain the degree of licentiate (either brewer or distiller) with a higher average grading than other licentiates, namely 650 points (65 per cent).

In this course some special students are received. They take the instruction, etc., and receive certificates of attendance if they attend regularly. Such students can not enter the examinations for degrees.

The school owns an experimental brewery and distillery in which the students spend a large proportion of the total school hours doing practical work. In addition to practical work in the experimental brewery all students taking the brewing courses leading to degrees must spend a certain time in a manufacturing brewery connected with the school. This period is called a "stage." It lasts 15 days during the first year and 30 days during the second year. This practical work is considered in the examinations and six-tenths of the total points allotted to the stage must be made before the work is considered satisfactory. Exemptions are made in the case of established brewers of Ghent, and established brewers outside of Ghent after they shall have conducted under given conditions a complete brewing operation at the experimental brewery. An arrangement is made in favor of nonresident students who can not reside continuously in Ghent during the 15 or 30 days whereby they may do the stage in a brewery in the neighborhood of their homes and furnish a certificate to that effect. In every case, under some condition, the student must have had practical work in an establishment before being graduated.

The courses are arranged so that those students who are already established in the brewing or distilling business may attend the classes without serious derangement of their affairs. To the first-year classes instruction is given on Friday and Saturday of each week from October 19 to January 11, and on Saturday of each week from January 18 to August 2. During the latter period one other day each week must be passed in the laboratory. For those first-year students who have not a sufficient knowledge of mathematics a supplemental course is arranged. From October 19 to January 16 they must spend 3½ hours per week in recitations, exercises, etc.

Classes in the second year receive instruction on Thursday and Friday each week and must devote Saturdays entirely to practical work in the experimental brewery or distillery, and to drawing, designing, laboratory work, etc. During this year practical work occupies a very large proportion of time. From October 25 to March 15, 9¾ hours a week, or more than half the total class hours, are set aside for practical work. From March 20 to July 26, the end of the school term for this and the third year, 8¼ hours for the brewing classes and 7 hours for the distilling classes are thus used. These hours are increased for certain weeks during the course; certain subjects are completed before the end of the year, and the same hours formerly devoted to them are spent in doing practical work. The practical work here spoken of is distinct from that done in the manufacturing brewery.

During the third year class exercises are held on Thursday, Friday, and Saturday of each week. Practical work occupies a large proportion of time, but not to such an extent as in the second year.

The following tables show the hours per week allotted to each subject or group of subjects during each year, according to the programme for 1901-02. Where two or more subjects are given on the same line, as, for instance, "Belgian brewing by top fermentation; bookkeeping," each subject occupies the hour shown for a part of the term. This fact accounts for the repetition of some of the courses in these tables.

FIRST YEAR.—GRADE OF MASTER BREWER OR DISTILLER.

Subjects taught.	Hours per week from—			
	October 19 to January 11.		January 18 to August 2.[a]	
	Brewers.	Distillers.	Brewers.	Distillers.
Raw materials and malting	2½	2½		
Boilers and management of steam engines	1¼	1¼		
Industrial designing and drawing	1⅛	1⅛	1⅛	1⅛
Fiscal law relating to brewing	1			
Chemistry (general)	1½	1½		
Chemistry of ferments			1½	1½
Physics (general)	1¼	1¼		
Physics; commercial law; supplementary lessons			1¼	1¼
Agricultural distilling and technology of the distillery		1		
Agricultural distilling and technology of the distillery; fiscal law relating to distilling; bookkeeping				1
Belgian brewing by top fermentation; bookkeeping			1	
Reviews, etc	1½	1½		
Total	10½	10½	5¼	5¼

[a] One additional day during this period must be spent in the experimental brewery, the laboratories, etc. The particular day had not been determined when the programme was printed.

SECOND YEAR.—GRADE OF LICENTIATE BREWER OR DISTILLER.

Subjects taught.	Hours per week from—			
	October 25 to March 15.		March 20 to July 26.	
	Brewers.	Distillers.	Brewers.	Distillers.
Analytic chemistry; polarimetry	1½	1½	.....	.....
Industrial construction; general mechanics; machinery	1	1	.....	.....
General mechanics; machinery; practical work	.....	.....	1	1
Chemistry of ferments	1½	1½	.....	.....
Brewing by top fermentation (comparison of); brewing by bottom fermentation	2½	.....	.....	.....
Brewing by top fermentation (comparison of); practical work	.....	2½	.....	.....
Utilization of by-products	.....	.....	1½	1½
Industrial physics	.....	.....	1½	1½
Industrial chemistry	.....	.....	1½	1½
Designing, drawing, etc.	1½	1½	5½	5½
Industrial distilling and technology of the distillery	.....	.....	.....	1½
Practical work (in experimental brewery or distillery, laboratories, etc.)	9¾	9¾	8½	7
Total	17½	17½	19½	19½

THIRD YEAR.—GRADE OF ENGINEER OF FERMENTATION INDUSTRIES.

Subjects taught.	Hours per week from—			
	October 24 to March 15.		March 15 to July 26.	
	Brewers.	Distillers.	Brewers.	Distillers.
Agricultural distilling and technology of the distillery	1	.....	.....	.....
Analytic chemistry	1½	1½	.....	.....
Organic chemistry; chemistry of ferments	1¼	1¼	1¼	1¼
Stability of constructions; applied mechanics	1¼	1¼	.....	.....
Applied mechanics	.....	.....	1¼	1¼
Utilization of by-products	.....	.....	1½	1½
Industrial economy	.....	.....	1	1
Industrial physics; electrotechnics	1½	1½	1½	1½
Designing and drawing	1¾	1¾	3¼	3¼
Fiscal law relating to distilling	.....	.....	a1	.....
Fiscal law relating to brewing; Belgian brewing by top fermentation	.....	1	.....	.....
Belgian brewing by top fermentation	.....	.....	.....	a1
Brewing by top fermentation (comparison of); brewing by bottom fermentation	.....	2¼	.....	.....
Industrial distilling and technology of the distillery	.....	.....	1¼	.....
Practical work (in experimental brewery or distillery, laboratories, etc.)	7¼	5½	5½	6¾
Total	15¾	15¾	17½	17½

a Until June 14.

Excursions under the guidance of an instructor are made to different breweries, distilleries, yeast factories, hop plantations, glucose, maltose, and vinegar factories, machinery manufactories, machine shops, etc. Regular students must attend at least three of these excursions during each year, and write detailed reports of their observations of the working of apparatus and accounts of the work in which they assisted. These reports are considered in the final examinations for degrees.

Examinations for all classes are held at the end of each school year by an examining board composed of members of the administrative commission, the faculty, and delegates of the State, the province of East Flanders, the city of Ghent, and of the brewers' and distillers'

associations. In determining the standing of the student everything, including examinations in technical and general branches, the practical work, quizzes during the course, reports on excursions of study to breweries and other industrial establishments, etc., is taken into account. The many subjects are grouped, each group being allotted a certain number of possible points and the minimum number of points that will be accepted. The standing required of the different classes is as follows:

STANDING REQUIRED OF STUDENTS OF EACH GRADE.

Grade.	Possible number.	Number required.
Brewery foremen and employees (free course)	1,000	500
Master brewer or distiller	1,000	537.5
Licentiate brewer or distiller:		
At end of first year	1,000	525
At end of second year	1,000	585
Engineer of fermentation industries:		
At end of second year	1,000	650
At end of third year	1,000	577.5

A registration fee of 50 francs ($9.65) for each student, payable each year, is required. Tuition fees are 400 francs ($77.20) for the first, 250 francs ($48.25) for the second, and 350 francs ($67.55) for the third year. Should any year's work be repeated, 200 francs ($38.60) is charged for the extra year. For laboratory work in chemistry and bacteriology and for the course in designing and drawing additional fees amounting to 50 francs ($9.65) per year, also payable by the special students, are exacted. All fees are payable in advance. Examination fees are charged in all classes. For the brewery foremen and employees (free course) the fee is 5 francs ($0.97); for the pay section it is 25 francs ($4.83) at the end of the first, 30 francs ($5.79) at the end of the second, and 40 francs ($7.72) at the end of the third year.

Subsidies are received from the State, the province of East Flanders, the city of Ghent, the general Association of Belgian Brewers, the Brewers' Association of Hainaut, and other associations.

The school is governed by a director and a committee of the Brewers' Association. The total number of students enrolled from the foundation of the school in 1887 until 1900 was 887. About two-thirds of this number were sons of brewers. The other third have become directors, master brewers, etc. Quite a number come from France and Holland, and a few from other countries, to attend this institution.

TECHNICAL SCHOOL OF BREWING, GHENT.

This school was established in 1894. It is not so important as the other Ghent brewing school. Its object is to educate students for the management of breweries of their own. Instruction includes both theoretical and practical work. It is given 3 days per week from

8 a. m. to 6 p. m. The school year lasts from the second Tuesday in October until the last Thursday in July. The duration of studies is 2 years.

All courses are obligatory, and include English, commercial law and commerce, physics, mechanics, brewing, chemistry, study of steam engines, chemical and bacteriological manipulations, fiscal law, and designing.

During 1895–96 there were but 19 students in attendance. The State granted a subsidy of 2,500 francs ($483) during the same year.

The following statement shows the hours per week given to each branch or kind of work, according to the programme of 1896:

HOURS PER WEEK FOR EACH BRANCH OR KIND OF WORK.

Subject.	Hours per week during—		Subject.	Hours per week during—	
	First year.	Second year.		First year.	Second year.
Brewing and malting	1½	1½	Physics	2	[b]1
Practical work in brewing	[a]1½	1–3	Commercial and fiscal law	1	1
Chemistry:			Mechanics	1	1
Inorganic	1		Steam engines		1
Organic		1	Bacteriology		[c]
Analytic		[a]1	Free-hand drawing	1	1
Chemical manipulations	[a]1	[a]3	Drawing plans, etc	1	1

[a] For one-half the school year. [b] Industrial physics.
[c] First half, 1 hour; second half, 1 hour to theory and 3 hours to laboratory work.

SUPERIOR SCHOOL OF TEXTILES, VERVIERS.

In 1894, after a discussion extending over several years, the city of Verviers opened a superior textile school. For its accommodation a special building had been constructed on land belonging to the city. It occupies a lot which originally contained 49,514 square feet, but to which 17,222 square feet have since been added by gift. The buildings, inclosing a central court, are in the form of a quadrilateral. In these buildings are installed two schools—the industrial and trade school of the city and the superior textile school.

The purpose of the superior textile school is the provision of the most advanced instruction in all matters relating to the manufacture of textiles. The course requires 4 years of study. The first year is reserved for the study of the pure sciences, the second to the applied sciences, and the third and fourth to the practice of the applied sciences. Taking the 4 years together, the greater part of the time of the students is devoted to the performance of practical work in the shops or laboratories.

The latest information for this institution is for the year 1896. According to the programme then in force the studies and practical work for each year were as follows:

First year: Physics (general); elements of mechanics; chemistry (inorganic and organic); descriptive geometry, pure and applied; botany; German and English; graphics; chemical manipulations.

Second year: Applied mechanics; industrial physics; industrial chemistry; elements of machinery; study of natural and artificial coloring matters; study of textiles; German and English; graphics; laboratory work, including chemical analyses, etc.

Third year: Theory of dyeing; electro-technics; technology of textiles; weaving; industrial architecture; construction of machinery; bookkeeping; German and English; graphics; laboratory work, including experiments in dyeing; shopwork in spinning, weaving, and electro-technics.

Fourth year: Theory of dyeing; electro-technics; technology of textiles; weaving; science of accounts; industrial geography; industrial economy; commercial law, German and English; graphics; plans; laboratory work, researches, etc.; shopwork in electro-technics, dyeing, spinning, weaving, and finishing, and visits to establishments, etc.

The school year begins in October and ends July 31. Instruction is given by day in this school, as it is in the other superior special schools.

The qualifications necessary for admission are that a candidate must be at least 16 years of age, and he must produce a certificate of good conduct from the authorities of his commune, and a certificate of successful vaccination or revaccination within the previous 10 years. If over 20 years old, he must prove that the military laws have been complied with. In addition to the foregoing general requirements it is insisted upon that a certificate or diploma of a high school (*athénée royal*) be presented, showing that he has successfully passed the first year of the scientific course. In lieu of such certificate or diploma he must pass an entrance examination. Special students may be enrolled for certain parts of the programme of studies. They do not receive diplomas, but may after examination receive a certificate stating they have studied the special branches.

Tuition is 250 francs ($48.25) for native born or naturalized Belgians and 1,000 francs ($193) for foreigners, and is payable in advance. For special students who are citizens a charge of 20 francs ($3.86) a year for each hour per week of each course taken is made, while foreigners must pay four times as much. In addition to the regular fees each student must deposit 50 francs ($9.65) each year as a guarantee against loss, breakage, and deterioration of material and instruments. Whole or part scholarships may in certain cases be accorded.

Those students who have no certificate of attendance on the high school, as required, must pass an examination in French, history and geography, arithmetic, algebra, geometry (including descriptive and analytical geometry), trigonometry, and drawing. A fee of 25 francs ($4.83) is charged for this examination. Examinations for passage from one year to another, as well as for graduation, are held. A minimum of 60 per cent must be made in each examination. A fee of 50 francs ($9.65) is charged for the examination for passage to another year, and one of 75 francs ($14.48) for the examination for graduation. In each examination the practical exercises, graphics, shopwork, mechanics, electro-technics, manipulations, analyses, experiments in

dyeing, original plans, quizzes, etc., in which the student takes part, are taken into consideration in determining the results.

In the industrial and trade school (evening) there is a trade department of textiles, which carries the same courses as the superior school. The instruction there given is of an elementary character, and is intended to prepare students for entrance into the superior school.

The government of this institution is vested in an administrative commission of 6 members, of whom 2 represent the State, 2 the province, and 2 the commune.

For the support of the two schools in 1896 the Government appropriated 25,138 francs ($4,852), the province 12,569 francs ($2,426), and the commune 25,137 francs ($4,851). Various other receipts amounted to 4,968 francs ($959), raising the total to 67,812 francs ($13,088).

SAINT LUKE TRADE SCHOOLS.

This is a special class of trade schools established under Catholic auspices. These schools present two types of organization. In the Tournay school the student receives his manual training in shops belonging to and under the direct supervision of the school; the other schools have no workshops, the student's manual training being received in outside shops. In the latter case the shops are nominally under supervision of the school, but it can not be said they really come under the school organization. They belong in most cases to graduates of the school who receive and train the students. The Tournay school resembles the trade school proper more than do the other three. The latter more properly come under the head of continuation schools.

These schools make a specialty of the Gothic style of art, but teach other styles also.

SAINT LUKE TRADE SCHOOL, GHENT.

The origin of the Ghent school has already been given. Starting as a simple drawing class in 1862, it has developed until in 1896 it was giving trade instruction to over 620 students. Since 1888 it has enjoyed a subsidy from the Government. The purpose of the school in general terms may be said to be the training of artisans capable of turning out articles possessing artistic or original features.

In its system of instruction it does not seek to replace the apprenticeship training obtained in industrial shops, but does attempt to shorten its duration. It seeks especially to give that training and theoretic and artistic instruction which can not be obtained in the ordinary shop. The work is divided into four distinct departments. First, a preparatory course that must be taken by all the students before specializing; second, a department of building; third, a department of decoration and ornamentation, and fourth, a department of industrial art. The curriculum comprehends seven years of instruction.

The school is installed in a building specially constructed for it. This building is well equipped for the work for which it is intended, but the increase in the number of pupils has crowded it and more room is urgently needed. The school has no workshop of its own. Instead it has the interesting system of making use of ordinary industrial shops. It had thus in 1896 arrangements with thirty-four employers, according to which each takes a certain number of pupils. These shops are visited at regular intervals by the professors who carefully supervise the pupils' work. To a considerable extent the employers making such arrangements are former pupils. Of the 34 shops in which students are trained, the work in 10 relates to carpentering, in 10 to decorative work and painting on glass, in 6 to stone and wood carving, while 5 are builders' and architects' offices, and 3 are designers' shops.

The instruction is given in the evening from 6 to 8 during the winter and from 7 to 9 during the summer. There are also special Sunday classes between the hours of 8.30 and 10.45 a. m., for those who can not spare the time on week days. In these courses instruction is given in the following subjects: Drawing of various grades; the theory of projections and perspective; industrial drawing; algebra, geometry, trigonometry, surveying; building technology; strength of materials; the elements of construction; the history of architecture and the related arts—archæology, esthetics, symbolism, iconography; building regulations; heating, ventilation, and hygiene of buildings; social economy; pattern making; carving; wood working, stone working, metal working; decorative painting, painting on glass, graphic work for miniature; engraving; embroidery; jewelry work, enameling, and wrought-iron work.

The instruction in drawing runs through all the seven years. In the first year is taught free-hand drawing of geometrical and ordinary objects; in the second, ornamentation, projection, and perspective; in the third and fourth, trade drawing, and in the fifth, sixth, and seventh, composition.

SAINT LUKE TRADE SCHOOL, LIEGE.

The Saint Luke trade school of Liege was founded in 1880 by a group of public-spirited citizens. Its purpose is the teaching of art as applied to industry. The school year begins October 1 and ends July 31. Instruction is given both during the day and in the evening. The day courses are held on every day in the week from 9.30 a. m. to 12 m. The evening courses are held on every week day, from 6.30 to 8.30 in the winter and from 7 to 9 in the summer. There is a special Sunday morning course, from 8.30 to 11, for the benefit of those who can not attend during the week. Pupils are admitted at the age of 13. Instruction is gratuitous. It includes a preparatory department for all the

beginners, a department of building construction and architecture, and a department of applied art and decoration.

The preparatory course requires two years of study. The trade courses proper require four years of actual study and three years more devoted to composition. Including the two years of preparation the student must spend nine years under the school's instruction.

In the preparatory department instruction is given in free-hand drawing (lines, geometric surfaces, leaves, flowers, and simple decorations); geometry and its applications, and elementary lessons in drawing from nature (first lessons in perspective, etc.).

In the department of building construction and architecture pupils are taught the fundamental principles relating to the different building trades or professions; restoration of monuments; knowledge of materials used in building operations; building legislation; archæology; geometry and calculus; and building technology. Great importance is attached to such details as doors, windows, floors, stairs, chimneys, framework, etc. In the course of applied art and decoration the student is instructed in sketching from casts and from nature, and the development of the sketches and their application to such arts as decorative or artistic painting; painting on glass; engraving on wood, stone, and metals; artistic ironwork, embroidery, upholstery, etc.; the study of costumes and furniture (both civil and religious), and modeling and sculpture relating to furniture and statuary. In each course trade drawing receives proper attention.

The department of building construction and architecture is intended for those pupils who wish to become carpenters, masons, stonecutters, blacksmiths, building contractors, or architects, etc., while the department of applied art and decoration is intended for the teaching of sculpture, cabinetmaking, gold and silver smithing, engraving, painting of various kinds, etc. There are now 8 teachers giving instruction in the various branches.

While the school has no workshop of its own, it has the use of certain shops maintained by the former students. It has thus had the use since 1887, of a shop in carpentry and wood carving; since 1891, one in painting; since 1895, one in fine ironwork, and, since 1896, one in stone carving.

During the early years of its history the school had to struggle against many disadvantages, the chief of which was an inadequate equipment due to lack of funds. Since 1895, however, it has been upon a better financial footing.

In 1901 there were 356 students in attendance, 46 of whom received instruction in day classes, 240 in night classes, and 70 in Sunday classes. There were 100 students in the preparatory department, 108 in the department of applied art and decoration, and 148 in the department of building construction and architecture. Among the graduates the school accounts for 30 architects, 16 building contract-

ors, 5 artistic painters, 40 house painters, 39 sculptors in wood and stone, 60 draftsmen, 10 blacksmiths, 15 engravers, and about 100 carpenters and 50 cabinetmakers.

SAINT LUKE TRADE SCHOOL OF SCHAERBEEK, BRUSSELS.

This school was created in 1884, after the model of the Ghent institution. In 1888 it was transferred to its present more commodious location. The purpose of this school is strictly that of teaching the technical application of art to industry, with a view to the training of a class of laborers having higher aims and more artistic ability than those trained by industrial establishments alone. From the start this school has secured the confidence and approval of both employers and the parents of youths seeking a trade education.

Instruction is given from 7 to 9 p. m. every day, with the exception of Sunday, during the months from October to July. In addition, there are lessons on Sunday mornings from 9 to 11.45 for the benefit of those unable to attend on the other days of the week. The scheme of instruction comprehends the following four departments: A department of general studies preparing for the other departments and which must be followed by all the students; a department of industrial art, a department of decoration and ornamentation, and a department of building and construction work.

The subjects taught are elementary drawing, trade drawing, geometry, architecture, building technology, building legislation, strength of materials, hygiene, social economy, history of art, sculpture, decorative painting, painting on glass, furniture, fine ironwork, gold and silver work, embroidery, and engraving.

Though great attention is paid to the practical instruction of the pupils the school has no shops of its own. Instead, use is made of shops run by former pupils of the school. It thus has the use of shops relating to the following five branches of industry: Cabinetmaking, stone and wood carving, fine ironwork, decorative painting, and painting on glass. The complete programme in one of the courses covers a period of seven years.

Instruction is gratuitous, although an admission fee of 3 francs ($0.58) is charged. Students must be at least 13 years of age and have completed their primary studies. The school started with 20 pupils. The following statement shows the number in attendance during more recent years: 1887–88, 165; 1888–89, 170; 1889–90, 300; 1890–91, 355; 1891–92, 425; 1892–93, 430; 1893–94, 448; 1894–95, 450; 1895–96, 450.

SAINT LUKE TRADE SCHOOL, TOURNAY.

The Saint Luke Trade School, of Tournay, was established in 1878 and placed under the direction of the Brothers of the Christian Schools. It began in a very modest way, with one teacher and a single class room. It has continued to develop, however, almost without inter-

ruption. Before the first year was finished, the increasing number of pupils necessitated the appointment of a second teacher. In 1880 the school was moved to a larger building; in 1885 a third teacher was appointed and a new class organized; in 1886 a new wing for the school was constructed; in 1887 a workshop for woodworking and wood carving was added; in 1888 the school was again transferred to more commodious quarters, a workshop for stone carving and decorative painting was added, and financial aid was first obtained from the Government; in 1893 the shop for stone carving was transferred to another room, and in 1896 the whole school was again transferred into better quarters.

The purpose of this school, like all of the Saint Luke institutions, is to train workmen in the more artistic or finer branches of the handicraft trades. The studies are divided into four categories. The first consists of studies which all of the students are required to follow; the second relates specially to building and architecture, the third to decoration and ornamentation, and the fourth to cabinetmaking. Seven years are required for the courses in drawing and theory, three of which are devoted to composition. The lessons are given from 6.30 to 8.30 in the evening during the winter months and from 7.15 to 9.15 during the summer months.

The subjects taught are drawing, trade drawing, geometry, the valuation of works and sketches, the technology of building, archæology; building construction from the theoretical, practical, and historical points of view; strength of materials, carpentry and joinery, stone and wood carving, modeling, statuary work, decorative painting, chromolithography, engraving, and decoration and ornamentation in their various applications to the trades.

The school now has four workshops, namely, a shop for woodworking, a shop for stone and wood carving, a shop for decorative painting and statuary work, and a shop for chromolithography and engraving. The report for 1896 mentioned that a workshop for gold working was in the process of organization, and it was hoped to establish one for painting on glass.

As soon as the apprentices begin to master the essentials of their trades a small remuneration is given for the work done. This remuneration, however, is retained and distributed in the way of prizes. The products of the students' work are sold and the money realized is used for the purchase of the raw materials and tools that are required. Care is taken not to compete with the manufacturers of the city. The students are employed in manual exercises in the shops every week day from 7.30 a. m. to 12 m. and from 1.15 to 4.30 or 6 p. m., according to the season of the year.

The following table shows the number of students and the number

of apprentices attending the shops during the school years 1884-85 to 1895–96:

STUDENTS AND APPRENTICES ATTENDING THE SHOPS OF THE SAINT LUKE TRADE SCHOOL AT TOURNAY, 1884-85 TO 1895–96.

Year.	Students.	Apprentices attending shops.	Year.	Students.	Apprentices attending shops.
1884–85	105	.....	1890–91	157	51
1885–86	120	.....	1891–92	170	47
1886–87	132	.....	1892–93	176	62
1887–88	134	21	1893–94	176	77
1888–89	142	31	1894–95	180	91
1889–90	150	29	1895–96	194	82

APPRENTICESHIP SHOPS FOR MALES.

The apprenticeship shops for weaving have been fully considered as a class, and need not be separately described.

The apprenticeship shops for stonecutting in the communes of Ecaussines-d'Enghien and Ecaussines-Lalaing, which are under one supervision, are fully described in the following pages. Other shops at Sprimont and Aywaille are of more recent origin.

APPRENTICESHIP WORKSHOPS FOR STONECUTTING, ECAUSSINES-D'ENGHIEN AND ECAUSSINES-LALAING.

In 1873 the communal council of Ecaussines-d'Enghien, upon the solicitation of the master quarrymen, decided to open a shop in which young boys could receive instruction in the trade of stonecutting. This action was taken because there was a distinct lack of workmen capable of doing other than the most ordinary work of stonecutting, and under such conditions but little opportunity existed for boys who entered the quarries as apprentices to learn the higher branches of the trade. The workshop was opened in a yard that belonged to the commune, and a methodical and progressive course in stonecutting was put in practice. The instruction was free, and from 25 to 40 students were constantly in attendance. The apprentices worked on stone brought in by the various master quarrymen who adhered to the shop idea. The master quarrymen also assisted the commune in many ways. They not only bore the expense of transportation of stone to and from the workshops and the loss from breakage and bad cutting, but paid the apprentices a regular schedule of prices for work done and also shared in the direct expenses of the shop. The work was done under the supervision and direction of a foreman employed for that purpose by the commune.

This shop, though it accomplished good results, presented a number

of grave defects. Great difficulty was found in securing continuous work for the apprentices. The work consisted principally in the making of staple articles, such as door and window sills and rough-trimmed stone, for which there was a regular demand and which could be kept in stock. Only to a limited extent could the finer grades of work, which are made according to a special contract, be secured. In consequence a larger number of the ordinary articles was made than could be disposed of. The cost of the work, moreover, was much increased by the fact that the yard was not in the immediate vicinity of the quarries and the expense of hauling the stone to and from the yard was a considerable item. Matters gradually became worse instead of better, and a change of system became imperative.

Until 1890 there was but one shop. In that year, however, a thorough reorganization was effected, and the multiple-shop system was adopted. Shops belonging to the employers were established in the quarries, and the time formerly lost in transporting the stone was thus saved. The apprentices were also brought into immediate touch with quarrying and cutting operations of all kinds. At the head of each of these shops was placed a foreman, chosen by the quarry owner with the approval of the administrative commission, who devoted his entire time to the instruction of the apprentices under him. The maximum number of these apprentices in each shop was limited to 20, as experience had demonstrated that this was the greatest number that could be directed with efficiency by a foreman.

For admission to the shops the boys must be at least 12 years of age and give proof of a sufficient primary education. They must also sign an agreement to follow regularly the courses of the drawing school, an institution which was established in connection with the original shop.

The apprenticeship is for three years of three hundred days each. At the completion of the term each apprentice who has satisfactorily fulfilled all the conditions is given a certificate, signed by the mayor of the commune and the representative of the superior authorities, setting forth the personal merit of the recipient.

The hours of labor are the same as those prevailing in the quarries in which the shops are located, due account being taken of the provisions of the law of December 13, 1889, regarding the hours of labor of young persons. The apprentices in these shops enjoy the great advantage that instead of paying for their instruction they receive a remuneration as soon as they are able to perform work of value. The work executed by them is paid for by the master quarrymen according to the rate prevailing in the quarry, but deductions are made from their earnings to the amount of 20 per cent during the first year, 10 per cent during the second, and 5 per cent during the third. The

sums thus retained are paid into the shop fund, and to them are added certain sums mentioned in the budget and the receipts from gifts and fines. At the end of the year the money thus accumulated is distributed in the form of prizes. Those apprentices who leave the shops without the permission of the administrative commission, or who are dismissed on account of incapacity or misconduct, lose all right to share in this prize fund. The prizes consist of stonecutters' tools or accounts at the Government savings bank. The main reason advanced for the retention of wages is to make sure that the apprentice shall have a full supply of tools when he leaves the shops. If he has already supplied himself with tools he receives the prize in cash.

On the 1st of January, 1900, the masters took a more decided step regarding payments to beginners. In order to encourage them for the first few months before their labor has become productive, the following system of premiums was adopted: (1) For the first three months of apprenticeship the sum of 0.50 franc ($0.10) per day of attendance, above the amount earned, is paid; (2) for the second three months 50 per cent is added to the earnings; (3) for the third three months 25 per cent is added to the earnings.

The shops are owned by the master quarrymen, but controlled by the communal administration through an administrative commission of 9 members, named, 3 by the commune, 3 by the province, and 3 by the State. This commission exercises a general supervision in all matters pertaining to the shops, the school of drawing, etc. The members visit the shops every month, examine accounts, take notice of the work and progress of the pupils, examine the notebooks, registers, etc.

In 1890, 4 shops of the character described were opened at different quarries. At the end of several months these shops had 80 apprentices. The results, the official report states, far exceeded the expectations of the most optimistic. During the next year 2 more shops were opened. Since then all of the quarry owners have become enthusiastic partisans of the system and have solicited the opening of shops in connection with their works. The authorities have promised to grant their desires as soon as practicable.

Apprenticeship shops for stonecutting have also been opened in a neighboring commune, Ecaussines-Lalaing. They are under the same administrative commission as those of Ecaussines-d'Enghien.

The following table presents the most important data relating to the multiple-shop system since its establishment in 1890. It shows the steady increase in the number of apprenticeship shops and of apprentices working therein, with the total days worked, total earnings, average daily earnings, etc. The figures relate to both Ecaussines-d'Enghein and Ecaussines-Lalaing, and are derived from the printed report for 1900 on industrial schools of the province of Hainaut and

from data for the working year 1900–01 furnished by the director of the shops and secretary of the administrative commission:

APPRENTICES, DAYS WORKED, EARNINGS, ETC., APPRENTICESHIP SHOPS AT ECAUSSINES-D'ENGHIEN AND ECAUSSINES-LALAING, 1890–91 TO 1900–01.

Year.	Number of shops.	Number of apprentices in regular attendance.	Total days worked.	Total earnings of apprentices.	Average daily earnings.	Amount distributed as prizes, etc.	Number who received prizes.	Number of diplomas granted.
1890–91	5	(a)	8,950	$696	$0.08	$156	(a)	.....
1891–92	6	109	22,236	2,540	.11	379	(a)	.....
1892–93	7	148	27,822½	3,769	.14	423	125	8
1893–94	10	218	38,099	5,160	.14	673	185	26
1894–95	11	254	44,132¼	6,215	.14	794	220	20
1895–96	11	265	55,464⅓	8,957	.16	1,025	223	31
1896–97	12	274	52,344⅜	9,147	.18	977	232	42
1897–98	11	256	47,985½	9,073	.19	1,042	207	33
1898–99 b	13	247	32,203¼	6,664	.21	894	213	16
1899–1900	13	305	55,896½	13,803	.25	1,236	262	23
1900–1901	14	313	61,268¾	15,215	.25	1,065	268	27

a Not reported.
b A strike of 5 months' duration which occurred during the year accounts for the small totals shown in some of the columns.

The number of shops has increased from the 4 originally founded in 1890 to 14 in 1900–01, and there are increases, more or less regular, in every other item. One of the most interesting facts shown by this table is the steady increase in average earnings of the apprentices. During the first year of the period the daily average was 0.40 francs ($0.08) and at the end of the period it had risen to 1.28 francs ($0.25). The averages given are for all apprentices, those who are just beginning and who earn practically nothing, as well as those in the second and third years of apprenticeship. The average earnings necessarily increase as the apprentice becomes more proficient. It should be borne in mind, however, that the amount of wages the apprentices may be able to earn is of secondary importance to the founders of these shops. Their great aim is to produce good workmen, and apprentices are not encouraged to attempt to earn high wages at the expense of thoroughness of instruction.

Many apprentices do not complete the three years of service. Some become tired of the discipline of the shops and leave. After six months' absence such persons are considered deserters and are dropped from the rolls. Others consider themselves sufficiently proficient before their time is served and leave the shops to secure employment in other places. Nearly all apprentices eventually work at the trade.

The cost of this system has been inconsiderable. The State and province share in the expenses.

DRAWING SCHOOL.

A school of drawing was established in connection with the original workshop in 1873 and is still in existence. Although all the apprentices must agree to attend this school many are excused for various

reasons. Instruction, which is practically free to all, is given five nights a week and Sunday forenoons. The State and province assist with subsidies.

Instruction is mainly industrial in character but is based upon a general course. The duration of studies is from two to five years, according to the course followed. The courses are, preparatory, 2 years (for pupils having an insufficient primary education); elementary and intermediate courses, 2 years each; course in modeling, 3 years, and superior course, 4 years.

The subjects taught in each course are as follows:

Preparatory course: Free-hand outline drawing, arithmetic, elements of geometry, French, industrial economy.

Elementary course: Studies in tracing, sketching geometrical figures, and projection drawing with instruments.

Intermediate course: Study of shadows, continuation of projection drawing, elementary perspective, and geometric outlines of shadows with instruments.

Course in modeling: Clay models of artistic moldings from plaster, from engravings, from sketches by the pupil after the masterpieces of antiquity, the Middle Ages, and the Renaissance.

Superior course: Study of architecture, etc., tracing relating to mechanics, stone cutting, course in technology, and building.

In 1899–1900, 198 students were enrolled, of whom 137 were in attendance throughout the year. The school is not so popular as it might be with some of the apprentices, but it is interesting to note that a number of older persons attend its courses to perfect themselves in their trades.

Of these 198 students, 60 were from 12 to 14 years old, 68 from 14 to 16, 34 from 16 to 18, 20 from 18 to 20, and 16 were over 20 years of age. Their occupations are given as: Students, 39; stonecutters' apprentices, 70; stonecutters, 44; clerks, 14; machinists and operatives, 5; draftsmen, 3; carpenters, 7; various occupations, 16.

TRADE COURSES FOR MALES.

In order to give a complete account of trade instruction in Belgium some mention should be made of courses, specially intended for the laboring classes, which have been organized in a number of cities. The purpose of these courses is quite analogous to that of the continuation schools of Germany or the science and drawing classes of Great Britain.

SAINT LUKE COURSES IN TRADE DRAWING, ANTWERP.

Of the various courses the most important mention should be made of those in trade drawing which have been organized in Antwerp by the "Vrede" society for workingmen in the building trades. Instruction is gratuitous and the pupils are supplied with the necessary implements and material as an encouragement to them to attend the

courses. For the most part the instruction is given by persons actually employed in the trades, namely, carpenters, joiners, blacksmiths, painters and decorators, etc. The courses are given exclusively on Sunday mornings, so that no interference with the regular work of the students will result, and they run from the first Sunday in September to the last Sunday in July. One hour is devoted to theory and two hours to practical exercises. To complete the courses, from 3 to 4 years are required. The pupils are required each year to make, in their own shops, some article or perform some work relating to their trade, in which the instruction obtained in the courses is put into practical execution. These articles become the property of the school. They are examined and arranged according to order of merit by a jury composed of persons not connected with the school. The courses are always attended by as many workmen as can be accommodated. Their number in 1896 was 126.

TRADE COURSES IN DECORATIVE PAINTING AND DRAWING, AUDENARDE.

In 1896 there was organized by the commune of Audenarde a course in drawing and painting as applied to the profession of interior decoration of buildings. This course is given on Sunday mornings from 9 to 12 and on Saturday afternoons from 5 to 7. Three years are required to complete the course. A tuition fee of 1 franc a month is charged.

TRADE COURSES IN DRAWING, HERVE.

A course in drawing as applied to the building trades was organized at Herve in 1893. The complete course extends over 3 years of 9 months each. The instruction is given on Sunday mornings from 9 to 12. An average of 25 students is in attendance.

In addition to these trade courses there are a number of courses in different cities in which commercial instruction is given. These, however, do not fall within the scope of the present report.

ATTITUDE OF EMPLOYERS, GRADUATES OF TRADE AND TECHNICAL SCHOOLS, AND LABOR UNIONS TOWARD TRADE AND TECHNICAL EDUCATION.

The following statements contain in condensed form the opinions of employers, graduates of trade and technical schools, and officers of labor unions in Belgium in reference to trade and technical education. The statements were made in response to inquiries in person by agents of the Department.

ATTITUDE OF EMPLOYERS.

FIREARMS MANUFACTURE.

A statement was received from a firearms manufacturer of Liege, who employs 400 men and boys, 3 of whom were graduates of the firearms school of that city. The reason that so few graduates are employed is because of the fact that the school, which is the first of its kind in Belgium, had been in operation only 3 years when the establishment was visited. The creation of the school, however, was due to the initiative of the Firearms Manufacturers' Association. The employer stated that he would prefer graduates as workmen; that such a training as could be received at the school was most needed by fitters and finishers, yet no position in the establishment could be filled without some previous training, and the training obtained in the school, he thought, would be preferable to that of the shop. He stated that the trade school furnished a more rapid and rational apprenticeship. Graduates would more easily find positions, would command better wages, and would advance more rapidly than other young men. The gun manufacturers think they have found, in the trade school, a means of supplying a better class of workmen.

GARMENT MAKING.

A firm of merchant tailors in Brussels assisted in the foundation and has contributed liberally to the support of the trade school of tailoring of that city. It urges young men wishing to become workmen in this industry to attend the trade school. Of the 40 men employed by them 30 are graduates of this school, hence it can readily be seen that the firm believes in trade education, as far as it relates to their industry. They stated that a trade-school education is most needed by cutters and fitters. In their opinion in all the occupations relating to the industry, except that of machine workers, the school training may replace that of the shop. They said that better work had been done since they began to employ graduates of the trade school; that, in their opinion, the most important advantage of the trade school was that boys really worked at and learned the whole trade there, while in the shops they did little more than run errands; and that graduates more readily found positions, received better wages, and advanced more rapidly than young men who had no trade-school training. The great trouble has been to keep boys in the trade school long enough. As soon as they become able to do work some tailors offer them wages and many leave the school. To prevent such desertions the firm thinks that employers should enter into closer relations with the school, have the students do work directly for them, and pay them in order to keep them in the school.

METAL TRADES.

For this group of industries statements were received from four establishments, in all of which graduates of trade or industrial-continuation schools were employed. The number of such employees varied greatly among the different establishments. Two establishments employed a considerable number of graduates from a genuine trade school where the metal and wood working trades are taught. Another establishment employed a few graduates of either trade or industrial schools, among whom were 4 foremen. The fourth establishment reported that 55 per cent of its 150 employees had either attended or had been graduated from an industrial school.

Three of the employers stated unqualifiedly that graduates of trade or industrial schools were preferred to those who had no such training, while the fourth stated that he preferred graduates for certain classes of work. All the employers agreed that employees in certain occupations were materially benefited by a trade or industrial school training. Such training was stated to be most necessary for blacksmiths, molders, core makers, turners, tracers, planers, fitters, patternmakers, countersinkers, sheet-iron workers, mounters, electricians, and draftsmen. The general opinion was that in nearly all occupations the school could not entirely replace shop training, but did render it easier, more rapid, and beneficial. One employer stated that for tracers, draftsmen, and electricians the school could entirely supplant shop training.

The four employers were unanimous in stating that a trade or industrial school graduate could more readily find employment than one who had no such training, and that as a general rule he was able to command higher wages and advance more rapidly. In reference to this question one employer said: "Graduates find it easier to obtain employment, because the diploma of the trade school [of Ghent] is a certificate as to their knowledge, morality, and trade capacity. Whether the wages of such graduates are higher depends upon their personal worth, but their school training gives a certain extra value to their services."

As to the practical benefits arising from the employment of graduates, one employer stated that better work was done in the mounting shop. Another, whose employees were to a large extent graduates of the industrial school of Jumet, stated that the work of those having diplomas in industrial and art designing is finer, more delicate, more artistic, and, above all, more precise than that done by others. Another employer said his establishment was benefited by the employment of trade-school graduates, because it could demand and obtain greater precision in the work of such employees.

In speaking of the most important advantages which the workman derives from a trade or industrial school training, allowance must be made for the character of the institution. One employer, referring

more particularly to the industrial (continuation) schools, stated that the chief advantage is the development of a young man's intelligence so that he more readily comprehends the work and the foreman's explanations. Two employers spoke more particularly in regard to trade education, such as is to be obtained at the Ghent trade school. Their testimony was to the effect that the combination of theoretical and practical instruction given in trade schools forms intelligent workmen who are able to produce better work in the end than merely shop-trained men can produce. One employer explained, however, that this result was not altogether due to the influence of the school. It was due as much to the fact that it was only the sons of the better class of workmen, those in easier circumstances, who were permitted to attend such schools, and that the schools required a certain degree of previous instruction of those admitted.

All four employers encourage attendance in the trade or industrial schools. One establishment requires young graduates of the local trade school who enter its employ to attend the evening classes, and reserves a series of lathes for their use. These pupils are supervised and instructed by a competent foreman. One establishment reported that it maintains a school for future foremen of the mounting shop, but nothing was said as to its working.

In regard to the manner in which the work of the trade and industrial schools may be improved, one employer suggested the extension of the manual work in the trade schools. An employer, in speaking of the industrial schools, recommended their improvement by joining apprenticeship shops to them. He also suggested joint action of employers to protect the students of such schools and to give them the preference over others; also the organization of excursions of study to the best establishments of foreign countries.

PRINTING AND PUBLISHING.

A printer and publisher who employed from 40 to 50 persons, among whom were 2 or 3 who had been graduated from the trade continuation school of printing of Brussels, said that graduates seeking employment will be given the preference over others. The two employers' associations of the city of Brussels have taken a prominent part in the foundation and support of the school just mentioned because they believe a trade school is necessary to train boys in the finer branches of the trade. The employer stated that while a trade-school training could be made to supplant that of the shop in some occupations, especially in composition, the system in vogue compelled students in the school to undergo a shop training equal to an apprenticeship. He said boys can learn all branches of the work at the trade school, instead of a specialty, and that graduates will obtain employment more easily and earn better wages than shop-trained boys. He encourages attendance on trade schools.

ATTITUDE OF GRADUATES OF TRADE AND TECHNICAL SCHOOLS.

In a statement signed by the president and secretary of the alumni association of the industrial school of Seraing the claim is made that students who are diligent in their studies are much benefited by attending the industrial school. Such study enables the students to learn their trade more rapidly and gain a higher wage than otherwise. Moreover, if a graduate from the industrial school wishes to change his place of employment he can more readily find a position and at better wages than one who has no school experience.

BLACKSMITHS.

A blacksmith employed in a machinery manufacturing establishment, and who is a graduate of the trade school of Ghent, said that his school preparation reduced the time of apprenticeship considerably, although he had to continue shopwork for some time in order to become an accomplished workman. He said his trade-school training enabled him to find employment more readily, to earn better wages, and to advance more rapidly than others. He thinks it preferable to attend the trade school rather than to begin work in the shop with a simultaneous attendance on the evening courses. His reasons for so believing are that in the school the students, while becoming skillful in the use of tools, receive instruction in the theory of the work which can not be given in an industrial establishment, and that employers express their appreciation of this form of education by giving trade-school graduates the preference over others.

CARPENTERS.

A carpenter who was graduated from an industrial school stated that since that time he had been able more readily to find positions, to secure a better class of work and higher wages, and to advance more rapidly than if he had not attended such a school.

DESIGNERS, METAL TRADES.

A designer in the metal industries, who formerly worked as a boiler-maker, said that since he had attended an industrial school he was able to earn a better salary, to advance more rapidly, to find work more easily, and to obtain a better position than before.

ELECTRICAL WORKERS.

Two graduates engaged in electrical work on railroads returned answers to the schedule of questions. Both attended the same industrial school and left it the same year, 1897. One had learned the practical work of his profession before entering the school, in which he studied mechanics and similar branches, that is, the theory of the work. The other graduate had simultaneously learned the practical

work in the shop and the theory in the evening classes of the industrial school. Both are of the opinion that a school training materially shortens the time necessary to become a good workman. In regard to the practical benefits arising from their school experience, one graduate said it had enabled him to find employment readily; one had found a better place than he could have found without the school training, and both were earning better wages and had advanced more rapidly. They hold the opinion that it is more advantageous to combine shop training with attendance at an industrial (evening) school than to learn the whole trade at a trade school, because the former training is more practical. One graduate made the point that the student meets cases in construction and repair work in the shops that can never be illustrated in a trade school.

FITTERS, MACHINE SHOPS.

Statements were received from three machine fitters, two of whom are graduates from industrial schools and one from the trade school of Ghent. The latter said the trade-school training had replaced a shop apprenticeship, but that it was necessary for him to spend some time in shopwork before he was regarded as a finished workman. In the case of industrial-school graduates, the question as to the extent to which the school replaces apprenticeship is in no case strictly applicable, because, as explained in another connection, the courses of instruction followed in such schools do not comprehend instruction in manual work. As regards the benefits derived from their trade or technical school training, all three fitters replied that it had enabled them to find positions more readily; one had found a better place and at a better salary; while two had advanced more rapidly. There is some difference of opinion as to whether it is better to attend a trade school in the first place, or to begin work in an establishment and supplement the knowledge there gained by attendance at an evening school. The two who had attended industrial (continuation) schools consider one plan as good as the other, but the trade-school graduate thinks the trade-school method is better than the shop training for turning out capable workmen.

FOREMEN, FOUNDRY AND MACHINE SHOPS.

Three foremen in foundries and machine shops returned answers to the schedule of questions. One was trained in a trade school, but did not report in what trade. The others were graduated from industrial evening schools. The trade-school graduate finished his apprenticeship in the school, but stated that considerable time was spent in an establishment before he became an accomplished workman. One of the industrial-school graduates said his school experience greatly facilitated his shop training and shortened the time necessary for him

to learn his trade. All three had been able to find places of employment more easily because of their school experience. They also reported that they had found better positions. In this connection one stated that he had been advanced from the position of planer to that of foreman directly after leaving the industrial school. His salary was 2.80 francs ($0.54) a day as a planer, while at present he said he was earning 6 francs ($1.16) a day. The others report better wages as a result of their school training. All three had advanced more rapidly than they otherwise could. They are in favor of the genuine trade school as a factor in the training of future workmen, but while two believe the trade-school experience should precede that of the shop, one thinks a boy should first receive a complete primary education, to be followed directly by shopwork in order to become familiar with the work, after which he should attend the trade school. In that way he thinks a boy will more easily become a good workman.

FOREMEN, PATTERN MAKERS.

A foreman of pattern makers, who was graduated from an industrial school, said his school training enabled him more readily to obtain a position, and that his present position as foreman was received after he had obtained a diploma. His wages were thus increased and his advancement had been more rapid because of his school experience.

FOREMEN, PRINTERS.

A foreman in a large printing establishment of Brussels, who also occupies a position as teacher in the trade continuation school of printing of which he is a graduate, stated that the instruction received in the school aided, developed, and completed his trade knowledge. Instruction in that school is given in the evening, hence it is not intended to supplant the apprenticeship. In fact, the students must work in printing establishments during the day as apprentices. At the end of 5 years if they successfully pass the required examination they are entitled to journeymen's wages. He believes that his present occupation as foreman and his position as teacher are due to the school training. He thinks the best results are obtained from combining regular work in an establishment (apprenticeship) with night attendance at a trade school.

FOREMEN, RAILROAD.

A foreman in the workshops of the State railroad considers his advancement due to the course taken in an industrial school. When he entered the school he was working as a fitter on the same railroad, but was promoted on leaving the school in 1892. He believes the course in the industrial school helped to develop him into a finished workman. As to the financial benefit arising from his school experience, he mentioned that his present salary is 180 francs ($34.74) a

month, whereas if he had remained a fitter he would be able to earn only from 90 to 110 francs ($17.37 to $21.23) a month.

GARMENT CUTTERS.

Two cutters of tailor-made clothing had attended the trade school of tailoring at Brussels. One reported that the school had in his case taken the place of an apprenticeship, and that on leaving school he could cut clothing. The other stated that for certain reasons he had not wholly learned the trade in the school. Their testimony is to the effect that graduates from the school are better educated and more thoroughly instructed and are more competent workmen than others, and that they thus have an advantage over shop-trained workmen in respect to wages, position, etc. They believe the school method of learning the tailoring trade is much better than a shop apprenticeship. Regarding this one cutter said: "At the school one learns how to do the work and why it is necessary to do it according to a certain method in order to obtain good results."

GUNSMITHS.

An employee in an establishment engaged in the manufacture of firearms said the instruction he received in the firearms trade school of Liege had taken the place of an apprenticeship. He had found employment immediately after leaving the school, and was gaining better wages and would be able to advance more rapidly by reason of his trade-school instruction. He said the school method is more advantageous and rapid than that of the shop, and that attendance in the trade school does not deter one from attending the technical courses of the industrial school at night.

JOINERS.

Two joiners, one of whom is a foreman, returned answers to the schedule of inquiries. The foreman had been graduated from the industrial school at Morlanwelz. He said the instruction there received had enabled him more readily to obtain employment, to gain better wages, and to advance more rapidly than if he had not taken the course. He stated that he had no knowledge of trade schools except that gained from graduates he had known, but he thought that the manner of learning the trade was no better than learning it under a master joiner of a village and then attending an industrial school. He believes the latter plan produces as good workmen as the trade school. The joiner had been graduated from the Ghent trade school, in which the instruction is intended to replace apprenticeship. He does not see that his trade-school education has given him much advantage over shop-trained workmen. The wages, positions, and chances for advancement are about the same for both classes. He thinks the trade

school offers better opportunities for acquiring a technical knowledge, especially in the metal trades, than does apprenticeship in the shops.

MACHINISTS.

Two machinists and a foreman of machinists reported that they were graduated from different industrial schools. While these schools do not attempt to replace the apprenticeship, one machinist stated that his time of apprenticeship had been shortened by his attendance at the school. Another stated that while he knew the practical part of his trade before entering the school, he was deficient in theoretical knowledge. One machinist had derived no benefit as far as wages, position, and advancement are concerned, but the other machinist and the foreman answered that they had been benefited in these matters because of their school training. All three believe it is advantageous to attend a trade school before entering an establishment.

MECHANICAL DRAFTSMEN.

Two draftsmen who had been graduated from industrial schools stated that while in their occupation the industrial school can not entirely replace shop training, it can more nearly do so than in most others. They had both been enabled by the knowledge gained at the schools to find positions more readily, to secure better positions, to earn higher wages, and to advance more rapidly than otherwise. One believes it advantageous to attend a trade school before beginning work in an establishment, while the other thinks it preferable to begin work in an establishment and at the same time attend an industrial school.

MINE BOSSES.

Three mine bosses who had been graduated from industrial schools reported that they had been enabled, because of the instruction therein received, to find employment more easily, to obtain better positions, to gain better wages, and to advance more rapidly in position. Two reported that the technical instruction in the school had been beneficial, as it enabled them to gain a more thorough knowledge of their work.

PAINTERS ON ENAMEL.

A painter on enamel stated that while the technical instruction he received in an industrial school had helped him very much and had complemented his shop training, he did not think the industrial or trade schools indispensable institutions for the ordinary workman, because the employer usually cares more for the quantity than the quality of work. He added, however, that he had been benefited in position and wages and had advanced more rapidly by reason of such instruction.

SPINNERS, COTTON.

A cotton spinner who was graduated from the Ghent industrial school stated that in general employers prefer those who have received a technical instruction, and that graduates are taken in preference to others for positions as overseer, etc. He further stated that in the weaving industry the industrial school is indispensable if one wishes to become an overseer, a director of an establishment, etc.

TAILORS.

Three graduates from the trade school of tailoring at Brussels returned answers to the schedule. One works as a journeyman and is also an instructor in the trade school from which he was graduated. The other two are owners of small merchant-tailoring establishments. None of them regards the trade-school training as a complete apprenticeship, because after leaving the school some time in the shop is necessary to form a complete workman. One said it takes about ten years to produce a good journeyman tailor. In answer to a question whether the trade-school training had enabled them to find employment more readily, to improve their position, to gain better wages, or to advance more rapidly, two answered affirmatively, and one said that he did not think the school training had helped him much. All three are in favor of beginning in a trade school. One thinks the student can do well enough in the school for two or three years, but should then go to work in a shop, as there the work is much different from that done in the school. The other two are more strongly in favor of the school. The journeyman, who is also a teacher, believes in the school because of the combination of theoretical instruction and practical work to be found there. He adds that if theory is not learned in connection with practice the student will often fail to gain a sufficiently comprehensive knowledge.

TURNERS, IRON.

An iron turner who was graduated from the Ghent trade school stated that in his case the school training replaced the apprenticeship, but such was not the case with most of his fellow-students. By way of explanation he said that one who had not received a sufficient primary school education could not profitably follow the instruction given in the trade school. He had not secured a better position nor obtained employment more readily because of his trade preparation. In regard to wages he stated that boys on being graduated receive less pay than other workmen who do the same work. He had been advanced more rapidly, however. He believes it is better to learn the trade in a trade school than to start directly in the shops and attend a night school.

ATTITUDE OF LABOR UNIONS.

METAL WORKERS.

A statement was received from the secretary of a metal workers' union of Ghent. Included in the membership of the union are 80 graduates from the metal-working branch of the trade school of that city. The secretary stated that it can not be denied that employers prefer workmen who have a trade-school education, and that some establishments make an effort to secure such workmen, but do not pay them according to their merits.

He had no knowledge of any case where a formal apprenticeship is now required in the industry. Speaking more particularly with regard to the Ghent trade school, he said that a school training can replace that of the establishment to a great extent, especially in forge work, although it can not do so completely because of the many systems of machinery and mechanical constructions produced in the city and about which the student learns nothing in the school. Proof of any great difference between the results of employing the shop and the school trained workmen has not as yet been produced, but there is less trouble in starting the trade-school graduate to work than there is with the so-called apprentice. Relative to this, however, the secretary stated that as both classes receive practically the same wages at 17 or 18 years of age, he concludes their capacity is about the same. He said that better foremen can be produced from the school graduates, however, because of their superior knowledge of the technical part of the work.

According to the secretary, the man who has a trade-school education can more readily obtain employment and advance more rapidly than one who has not. Regarding the principal advantages of a trade school, he said it enables boys to become good pattern makers, molders, metal turners, fitters, and blacksmiths; that in its workshops they learn the trade better and more easily than in the establishment; that a more complete knowledge of the trade is gained in the school, because it teaches all the operations; and that the continuation courses (evening and Sunday) are of great service in developing as planers, drillers, mortisers, etc., persons employed as laborers and apprentices. The trade school is of great advantage to the employer because its students are further advanced according to the workmen's rules than are other young men of the same age.

The union, the secretary stated, encourages its members to educate themselves. It has a library containing works in reference to the trades. Each year new books are purchased for the use of the members. He suggested that the work of the trade schools could be much improved by adding another year or more (in the case of the Ghent

school) to the courses of instruction and by paying the students something for their work, thereby satisfying the parents and arousing a proper spirit in the students. He believes the payment of a salary to the student for work done in the school would develop in him the idea of conserving the employer's interests and consequently his own. He thinks employers should require their mechanics to attend trade schools.

PRINTERS.

A prominent member of the Compositors' and Pressmen's Association of Brussels, who holds an official position in this and a number of subsidiary organizations, considers the trade and industrial schools useful and necessary from the workmen's standpoint, because, he said, at this time when machine methods are invading all industries, when the large industries are constantly developing and crowding out the small establishments, it is very difficult for a young man to become a good workman if he has not attended an industrial or trade school.

Speaking of conditions in general, he said that in most trades not enough attention is given to the apprentice. His employer often does not endeavor to instruct him in the rules or the necessary details. It is generally in a spirit of speculation that the apprentice is engaged, and not with a view of teaching him the trade. Hence, he is usually kept on some special branch of the trade during most of his apprenticeship, and when his time is served he is still an ignorant and unskillful workman so far as the other branches of the trade are concerned. This, he said, is particularly true in the printing industry, where one can see some unscrupulous employers filling their establishments with boys without having determined whether they possess the necessary aptitude and degree of instruction to become good workmen. Such boys are kept on rudimentary work and are required to produce all that is possible. Their trade education is wholly neglected, and on reaching the age of manhood they are incompetent and shiftless and render the struggle for the betterment of conditions of labor more and more difficult.

It is the aim of the trade and industrial schools to remedy such conditions. The association, the secretary said, took a prominent part in the foundation of the trade school of printing at Brussels for the purpose of bettering conditions in the printing industry. It entered into relations with the employers whereby both sides receive equal representation on the administrative commission and pay an equal sum in support of the school. The limitation of the apprenticeship is governed by an agreement which is also a part of the organic law of the school. The agreement is to the effect that all apprentices admitted into the establishments of the employers who adhere to the school shall be at least 14 years of age and must regularly attend the school. The

number of apprentices is limited so that establishments employing from 1 to 6 workmen are allowed 2 apprentices, those employing 7 to 14 workmen may have 3, and those employing 15 to 25 workmen may employ 4 apprentices. One extra apprentice is allowed for every 10 workmen in excess of 25. In arriving at these figures press hands are not counted.

CHAPTER V.

TRADE AND TECHNICAL EDUCATION IN CANADA.

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In Canada not much has yet been done in the way of strictly trade education. The Ontario government has a flourishing agricultural college and experimental farm at Guelph, which has been in successful operation since 1874. In connection with this is a dairy school, and other dairy schools are conducted at Strothroy and at Kingston.

Of schools of industrial art there are 7 in the province of Quebec and 6 in the Province of Ontario, all receiving government support.

At Toronto is a free evening technical school supported by the city, which has been very successful. A watch-repairing school under private auspices completes the list of Canadian industrial schools, the School of Practical Science of Toronto being of collegiate rank and above the scope of this report.

A description of the foregoing individual schools follows:

ONTARIO AGRICULTURAL COLLEGE AND EXPERIMENTAL FARM, GUELPH, ONTARIO.

This institution was established in the year 1874, and is situated about one and one-fourth miles from the city of Guelph. It is a well-equipped agricultural college and offers instruction in all the subjects usual in such a school. Only the courses in dairying come within the scope of this inquiry.

This department is fully equipped for giving instruction in milk testing, butter making, cheese making, the running of cream separators, handling of milk, treatment of cream, pasteurization of milk, and feeding and management of dairy cows. In fact, nothing is lacking that is necessary to give the broadest and most thorough training in every branch of the dairy business on a large scale suited to factory and creamery men, and on a small scale adapted to the circumstances of those who have to handle milk and cream and make butter on the farm.

There is a special short course given during the month of December to meet the needs of pupils who expect to engage at once as butter makers. This course embraces instruction in the running of cream separators of different makes, the pasteurization of whole milk and cream, care and ripening of pasteurized and raw cream, use of acid test for cream, running of box churns, the combined churn and worker and the Mason worker, the preparation of butter for local and export markets, and other work of a practical character; also instruction in the testing of milk with the Babcock tester and the lactometer, in the

use of the oil-test churn, in composite sampling, and in the making up of factory accounts, so that the students may have a thorough knowledge of how to run a creamery properly. There are no examinations, and no certificates are given in this special course.

There are two factory courses, one of three weeks and another of six weeks' duration. These courses provide theoretical and practical instruction in cheese making and the curing of cheese, butter making (both separator and cream-gathering plans), and the preparation of butter for market; milk testing with the Babcock tester, lactometer, and oil-test churn, and pasteurizing whole milk and cream. They also include fermentation tests, the use of starters, dairy bacteriology, agriculture in relation to dairying, the factory records and accounts, etc.

Discussions on practical dairy topics, led by one of the instructors, are held four afternoons in each week. These discussions last for one hour, and are of much value to students. Experts are brought to the school from time to time to give lessons in the judging of cheese and butter. Special instruction is given in the care and running of boilers and engines. There is also practice in pipe fitting, repairing valves, etc.

The Ontario government conducts dairy schools at Strothroy and Kingston. No information is at hand for these schools further than that it is stated that the courses are substantially the same as those at Guelph.

SCHOOLS OF ART AND MANUFACTURES, PROVINCE OF QUEBEC.

The establishment of these schools was brought about by the manufacturing interests of the Province. They were organized by act of legislature in 1872. Previous to this date no instruction in drawing or industrial courses was provided. The seven schools are located in the following places: Montreal, Quebec, Levis, Sherbrooke, Sorel, Three Rivers, and St. Hyacinthe.

The schools are under the management of the Council of Arts and Manufactures, composed of 17 members appointed by the lieutenant-governor. The commissioner of agriculture and colonization, the provincial secretary, and the superintendent of public instruction are ex officio members of the council.

The powers and duties of the council are as follows:

To take measures to collect and establish at Montreal and elsewhere, for the instruction of practical mechanics and manufacturers, museums of minerals and other materials, substances, and chemical compositions susceptible of being used in mechanical arts and manufactures, with model rooms appropriately stocked and supplied with models of works of art, implements, mechanisms and machines of any kind (except those adapted to facilitate agricultural operations), and free libraries containing books of reference, plans, and drawings, calculated to impart useful information in connection with mechanical arts and

manufactures; to take measures to obtain from foreign countries new or improved implements and machines, and test the quality, value, and usefulness of the same; to make rules and regulations for the establishment, management, administration, and carrying on of a system of instruction in drawing in all its branches in the schools under the control of school commissioners and trustees, etc., and generally to adopt every means in its power to promote improvement in the mechanical arts and manufactures in the Province.

These schools are chiefly intended to afford instruction in drawing and its useful application in industrial pursuits, more especially for artisans and apprentices. The aim is to make the instruction as practical as possible, that the pupils may profitably apply the knowledge gained to the various trades and branches of industry in which they are engaged.

The following statement shows the number of classes, number of pupils, average attendance, and the number of teachers during the school year 1898–99:

NUMBER OF PUPILS AND TEACHERS AND AVERAGE ATTENDANCE OF SEVEN SCHOOLS OF ART AND MANUFACTURES, 1898-99.

School.	Number of classes.	Number of teachers.	Number of pupils.	Average attendance.
Montreal	12	16	463	287
Quebec	7	7	244	126
Levis	7	5	279	126
Sherbrooke	2	2	54	29
Sorel	1	1	34	11
Three Rivers	1	1	69	24
St. Hyacinthe	1	1	24	9
Total	31	33	1,167	612

As will be seen by the above table, the Montreal school is by far the largest and most important.

The schools are maintained by a government grant of $13,000. Of this amount the school at Montreal utilized $6,000, or nearly one-half of the total grant.

The following table shows the classes taught in each of the seven schools during the year:

SCHOOLS IN WHICH CLASSES IN EACH SPECIFIED SUBJECT ARE TAUGHT.

Class.	Schools having such class.
Free-hand	Montreal, Quebec, Levis, Three Rivers, Sorel.
Free-hand, senior	Montreal, Quebec, Levis.
Decorative painting	Montreal.
Architecture	Montreal, Quebec, Levis, St. Hyacinthe.
Mechanical	Montreal, Quebec, Levis, Sherbrooke, St. Hyacinthe.
Lithography	Montreal.
Boot and shoe	Montreal, Quebec.
Modeling	Montreal, Quebec, Levis.
Stair building	Montreal, Quebec.
Plumbing	Montreal, Quebec.
Ladies' dress cutting and making	Montreal.
Lectures	Levis.
Practical geometry	Levis, Sherbrooke.
Linear drawing	Three Rivers, Sorel.

The drawing classes are not intended to make expert draftsmen, but to provide mechanics with an opportunity of obtaining a knowledge of drawing which will be of assistance in their trades.

The mechanical drawing classes are for those who follow mechanical pursuits. Apprentices and others employed in the different departments of machine building find the instruction offered in these classes of great value. The aim is to make the instruction of a thoroughly practical character and to enable the mechanic readily to make and read such drawings as generally come before him in his trade. Figured sketches and blue prints of familiar details of machine designs are used. These the pupils are required to copy, enlarge, reduce, etc., or, as progress is made, from a series of sketches of parts to assemble into general drawings the completed machines.

The architectural drawing classes are intended for carpenters, plasterers, tinsmiths, roofers, etc., and the instruction is adapted as far as possible to the requirements of the pupil. Exercises are given in geometry and projection, and pupils are taught the details of framing, plan, and elevations of buildings and the preparation of working drawings.

The object of the class in stair building and building construction is to enable carpenters, builders, and others to make tracings and drawings of stairs and other work and to execute the same in the class rooms, special attention being given to stair building. Tools and materials are provided for this purpose. Lessons and explanations are given in regard to matters relating to the construction of buildings.

The classes in plumbing are arranged for apprentices, journeymen, and foremen engaged in any of the branches of plumbing. The class rooms are equipped for both class and individual work, each pupil having a gas furnace for melting solder and a drawer for holding tools. Instruction is given in lead bossing, pipe bending, soldering and wiping joints, lead burning, water-closets, preventors, baths, lavatories and sinks, traps, soil pipes and drains, sizes of pipes, etc., water supply, house cisterns, the use of tools, etc.

The lithographic class is to afford apprentices and workmen in establishments where lithographic and similar work is done an opportunity to gain instruction and to practice work which they are not permitted to do in the places where they are regularly employed.

The instruction commences with the preparation of the lithographic stone for work and proceeds by regular steps till the pupil is able to finish a drawing on the stone ready for the press. The class is open to all who are sufficiently advanced in drawing to enable them to pursue the work with advantage, the stones and other materials required being furnished free of cost to the student.

The pattern-making classes for boot and shoe makers are for the purpose of giving practical training in the making of patterns of boots

and shoes of all descriptions and also to give instruction in regard to the materials used in making the same. The course is especially arranged for persons employed in the cutting departments in boot and shoe making establishments. Pupils are required to fit and adjust patterns to the last.

Each pupil is supposed to have provided himself with necessary tools. In some of the schools a small entrance fee of $1 is required, but this is returned at the end of the session to those who have not been absent more than four times.

Four of the schools, viz, those at Montreal, Quebec, Levis, and Sherbrooke, are in a very promising condition. They are well attended and are attaining the end for which they were established. But the remaining three—Sorel, Three Rivers, and St. Hyacinthe—are not progressing so rapidly and are in general not so satisfactory. This is largely due to a lack of interest manifested by the inhabitants of those cities.

CENTRAL ONTARIO SCHOOL OF ART AND INDUSTRIAL DESIGN, TORONTO, ONTARIO.

This institution was established in 1890, as the successor of the Toronto Art School, under which name it was founded in 1876.

There are 6 instructors, and the course of instruction is as follows:

Primary course: Free-hand drawing, perspective, model drawing, memory drawing, practical geometry.

Advanced course: Shading from flat examples, drawing from natural objects, outline drawing from the round, shading from the round, industrial design.

Mechanical course: Projection and descriptive geometry, machine drawing, building construction, architectural design, advanced perspective.

Industrial art course: Wood carving, lithography, wood engraving, modeling in clay.

Special subjects: Painting in oil and water colors, painting and drawing from life models, embossed leather work.

The following occupations were represented in the student body last session: Photographers, 2; lithographers, 42; designers, 5; engravers, 7; draftsmen, 5; clerks, 10; school teachers, 18; machinists, 4; printers, 2; bookkeepers, 4; wood carvers, 2; illustrators, 7; glass stainers, 2; bookbinders, 3; architects, 2; photo-engravers, 5; stonecutters, 3; jewelers, 3; decorators, 5; students, 27; sign writers, 2.

From the financial statement issued by the secretary May 15, 1900, it appears that the school received a grant from the government of $540, a city grant of $750, and the income from tuition fees amounted to $1,816.50, making a total of $3,106.50 available for operating and maintaining expenses.

It is said that the total amount of grants from the city and from the government during the first eight years averaged less than $1,000 per annum. As there were about 160 students reported the last year, this

gives an average of about $6.25 of public money per pupil expended by the government per annum.

There is hardly an engraver, lithographer, or artist in the city of Toronto who has not at some time attended classes connected with the school.

The school year begins in October and closes in April, and is composed of three terms of ten weeks each.

The attendance for the year covered by this report was as follows:

The total number of students attending during the first term was 110; of these 43 were females and 67 males. During the second term the total number was 127, of which 53 were females and 74 males. During the third term there was a total of 133, of which 66 were females and 67 males.

The class rooms are open daily from 9.30 a. m. to 4.30 p. m.

Besides the regular day classes there are evening classes which, though open to all, are particularly intended for those employed during the day.

The work in this school is especially adapted to those whose business requires a knowledge of art, as prominence is given to design for various industrial purposes. The wood-carving class is conducted on the same lines as the School of Art and Carving, South Kensington. Modeling in clay is given special attention.

The school has made great progress and the attendance has steadily increased.

Many of those who have attended the school are now occupying good positions in Canada and the United States, and many prominent artists and designers were at one time in attendance at these classes.

SCHOOLS OF ART, PROVINCE OF ONTARIO.

Besides the Central Ontario School of Art and Industrial Design, details relative to which have been given, there are five other art schools in the Province which are supported partly by government grants.

These schools are attended by representatives of various trades and professions, and are located at Hamilton, Kingston, London, Ottawa, and St. Thomas.

Full information regarding these schools is not at hand, but some little idea as to their scope and character may be gained from the following extracts taken from the report of the minister of education of Ontario for the year 1899:

The report of the Hamilton Art School for the year ending the 30th of April, 1899, shows that 198 students took the regular course of study during the year. The total number of attendance registered is 8,249.

In addition to the instruction given in all grades to students residing in the city of Hamilton, students from six other towns in the

Province participated in the advantages derived from the Hamilton Art School.

As the fee of $2.50 for 20 lessons was thought to be more than apprentices and young people could afford to pay, the directors decided to reduce the amount to $1 for 20 lessons. The result was an increased attendance, and, although there was a slight decrease of income, the benefit derived by the students more than counterbalanced the pecuniary loss.

The equipment of the school has been increased to meet its requirements during the year.

The receipts, including the government grant, were $2,958.72; expenditures, $2,953.72.

The report of the Kingston Art School for the year ending April 30, 1899, shows that the school was removed to a more commodious and central position since the last report. The new rooms are furnished with modern appliances, which has been the means of increasing the attendance to 40 students in the day classes and 20 students in the evening classes.

In addition to the four courses prescribed by the education department, painting in oil and water colors is taught.

The receipts, including the government grant, were $626.20; expenditures, $626.20.

The report of the London Art School for the year ending April 30, 1899, shows a decrease in the number of students. The report shows 53 students in the primary course, 23 in the advanced course, and 17 in the mechanical course.

The receipts, including the government grant, were $972.14; expenditures, $969.96.

The report of the Ottawa Art School for the year ending April 30, 1899, shows that for the purpose of teaching decorative design the directors engaged, at considerable expense, a special instructor, certified by the New York School of Applied Design for Women, whose work they say has been of a highly satisfactory character.

The report shows 37 students in the primary course, 26 in the advanced course, 12 in the mechanical course, 3 in the industrial art course, and 18 in oil and water-color painting.

The receipts, including the government grant, were $1,813.70; expenditures, $1,529.50.

The report for the St. Thomas Art School for the year ending April 30, 1899, shows that 27 students attended the primary course, 29 the advanced course, 30 the mechanical course, and 16 the industrial art course.

TORONTO TECHNICAL SCHOOL, TORONTO, ONTARIO.

This is a free evening technical school, the first of its kind established in the Dominion of Canada. Its purpose is to impart practical and scientific instruction to the artisan and working classes.

The institution was opened January 25, 1892.

The school is entirely free, there being no fee or charge of any kind. The session lasts about seven months, and the daily hours are from 7.45 to 10 p. m., five days in the week.

All applicants for admission must be at least 15 years of age and possess a working knowledge of reading, orthography, penmanship, and composition.

At the beginning of the session all new pupils are examined and graded in mathematical subjects, and only such of them as are found capable of taking up the work advantageously to themselves are permitted to enter classes in the science departments.

The curriculum, which embraces practical and theoretical instruction in physics, mechanics, chemistry, domestic science, geology, mineralogy and metallurgy, machine construction and drawing, building construction and drawing, geometrical drawing of the various kinds, industrial art (including drawing, designing, and modeling), electricity, and steam and gas engines, is so arranged as to be divided into five regular departments and four special courses.

The departments comprise physical science, machine construction, architecture and building construction, chemistry, and industrial design.

The special courses give instruction in domestic science; mineralogy, geology, and metallurgy; electricity, steam and gas engines; clay modeling and historical ornament.

The work in each of the regular departments of study requires about three years for its completion, and all students are strongly advised to take up the full work of some one department and pursue it to completion.

The course in industrial design is as follows:

First year: Free-hand drawing—Drawing in outline from the flat, from groups of geometrical solids, from objects, memory drawing. Industrial design—Geometrical and free-hand designing in flat outline, historical ornament (ancient). Mechanical drawing—Elementary perspective, practical geometry. Mathematics—Mensuration, (first year), Euclid, book 1 (one term only).

Second year: Free-hand drawing—Drawing in light and shade from the flat and model, from groups of geometrical solids, from ornamental casts, from objects, memory drawing. Industrial design—Designing from plant forms in outline (flat), elementary color (flat), historical ornament (medieval).

Third year: Free-hand drawing—Continuation of work of second year, drawing in monochrome, memory drawing. Industrial design—Plastic design, historical ornament (modern), history of design, clay modeling.

Work in the special courses is intended largely to supplement the work done in the regular course, but it is of a much more practical nature.

The aim of the course in clay modeling and historical ornament is to give artistic training specially suited to the wants of artisans and designers in terra cotta, stone, wood, and those lines of manufactured goods where modern ornament is applicable. The student advances to the principles of form and proportion involved in designs of various kinds, and the adaptation of modeling designs to different classes of

work, and instruction and practice are given in the making of molds and the finishing of casts. The model room is capable of accommodating about 15 pupils at one time, and the storeroom is supplied with a large number of selected and appropriate models. An abundance of well-prepared material is always on hand and the modeling and cast making are done in separate rooms, both plaster and gelatin being employed in the processes.

The modeling room is at all times open for either instruction or practice, but all casting and mold making is required to be done under direct supervision of the instructor.

This course is especially suited to those who have completed the work either in architecture and building construction or industrial design, but it is open to those who take lectures in historical ornament of the first and second years in the department of industrial design.

All drawings and models made by students while pursuing studies in either the regular or special courses are required to be handed in before the close of the session for examination and comparison, or for exhibition, should they prove worthy. These are afterwards returned to the student and become his personal property, the board reserving the right to retain one drawing and one model made by each pupil.

The school is under the control of a board of management consisting of the mayor of the city of Toronto and representatives of the city council, Trades and Labor Council, Society of Stationary Engineers, Architects' Association of Ontario, manufacturers, and educationalists.

The faculty is composed of 13 instructors, 5 of whom are graduates of Toronto University, 3 of the Toronto School of Practical Science, 1 of the University of Belfast, Ireland, and 1 of the science and art department of Kensington Technical School, Southampton, England, while 3 are holders of certificates of proficiency from local schools. Besides being holders of degrees in science, 3 of the teachers hold degrees in medicine and are licensed practitioners.

Regular courses of study have been instituted during the last five years only, and it requires from three to five years to complete one of the courses, so there have as yet been but 9 graduates. The enrollment for a recent year reached more than 1,100. They were registered in the different departments as follows:

Regular courses—	
Physical science	243
Machine construction	171
Architecture and building construction	90
Chemistry	86
Free-hand drawing, design, etc	148
Special courses—	
Domestic science	375
Mineralogy, geology, and metallurgy	23
Electricity, and steam and gas engines	51

Up to the present time the school has occupied a building rented at $1,000 per annum, but a building of its own is just being completed which will, when completed, cost $75,000, including furniture and fixtures.

The institution is equipped with scientific apparatus which cost about $6,500, while the cost of maintaining the school, including rent, insurance, and annual expenditure for apparatus has ranged from $9,000 to $11,000 per annum. The combined salaries of the faculty are less than $7,000 per year. These funds are supplied wholly by the municipality of Toronto.

The institution can not be said to have particularly benefited any one industry, but it has served to increase the intelligence and scientific skill of many hundreds of citizens, and has thus indirectly benefited all manufacturing industries.

There have been a great many cases where wages of students attending this school have been doubled as a consequence of increased efficiency, and, true to the object of its establishment, the institution is endeavoring to promote a knowledge of scientific facts and principles among artisans and working people, and is trying in every way to further the development of industrial pursuits.

The Trades and Labor Council has done a great deal toward advancing the interests of the institution. Out of the 21 members of the board of management 15 are representatives of various labor organizations, and the labor bodies of the community have in every possible way given the school moral support and endeavored to promote its welfare.

Labor unions have in no way opposed the institution.

Its graduates are preferred by employers over merely shop-trained apprentices, and it is felt that the institution has given general satisfaction to all persons concerned, and is attaining the end for which it was established.

CANADIAN HOROLOGICAL INSTITUTE, TORONTO, ONTARIO.

This institution is devoted exclusively to the study of watch repairing. It was established in 1890.

The curriculum presents three courses of study—a full course, an intermediate course, and an improver's course.

The full course is for those without experience. It includes construction of a limited number of small special tools, the thorough repair and alteration of all kinds of watches and clocks, and the construction from solid material, after the pupil's own design and calculation, of a high-grade watch with lever or chronometer escapement. It requires two years to complete this course, and persons without previous experience are not permitted to enter it for a shorter period.

The intermediate course is for young men who have had several years' experience at the trade. It covers a period of a full school year of eleven months, and includes the construction of a few small tools and repairing of watches. Where the ability, aptitude, and inclination of the student warrant it, the finishing up of a lever watch movement from the rough is added. In such cases the parts of the movement are made but are not fitted or finished.

This is next to making a watch and is so considered in a great many schools. But if, instead of finishing a watch as above described, the pupil should prefer, he may finish up an escapement model and a micrometer gauge from the rough.

The improver's course is for workmen who have completed an apprenticeship. It embraces the construction of a few special tools and the thorough repair of watches from barrel to balance. This course covers a period of six months.

Besides an average of thirty-eight hours per week devoted to practical work at the bench by each pupil, all pupils are required to devote three hours per week to lectures upon the natural laws governing timekeeping mechanisms; their intelligent application in practice; the accurate calculations required for all kinds of gears and escapements; the calculations for the caliber of watches, chronometers, and clocks, and an average of four and one-half hours per week to the subject of drafting.

The tuition fee for the full course is $165 per year where the student furnishes his own lathe, and $180 when the lathe is provided by the school. Tuition is the same for the intermediate course, but for the six months improver's course the fee is $100 where the student furnishes the lathe and $110 if it is furnished by the school.

The institution is under the management of a director, who is the only instructor. He received his training as a practical workman in the shop, and is self-taught in the scientific branches.

From 15 to 20 pupils are in attendance, and out of the 172 persons who have matriculated during the ten years or more of the school's existence but 16 have been graduated.

The equipment of the building, which is rented at an annual rental of $400, cost about $8,000. The cost of maintaining is $2,500 per annum. These funds are derived from tuition fees and receipts from repair work.

It is claimed that those who attend the school learn the trade in a shorter time than is required in the old-line apprenticeship system, and its graduates find greater pleasure in their work, their salaries are higher, and their advancement more rapid in every way. The graduates are now preferred over merely shop-trained apprentices, though they were at first viewed with suspicion.

ATTITUDE OF EMPLOYERS AND LABOR UNIONS TOWARD TRADE AND TECHNICAL EDUCATION.

Two statements have been received from Canadian establishments, one of which is from the manager of a cotton factory and the other from the manager of a carpet factory. While the report from the latter source is the only one answered in detail, yet the statement furnished by the former, being based upon an experience of twenty-eight years in the textile industry, is worthy of consideration in this connection. The statement of the manager of the carpet factory is substantially as follows:

We have three men in our designing room, two of whom are graduates of the leading English schools of art and design, and one from the Central Ontario School of Industrial Art and Applied Design, at Toronto, Canada. The special education of these men has undoubtedly helped to improve the general character and quality of our product. The remuneration they receive is equal to that of our foremen. Both design and good workmanship are essential to success in this business. While further provision for technical schools and schools of design would undoubtedly be a great benefit to our industry at large, still the lack of such provision would affect us only to the extent of the inconvenience incurred by being obliged to procure educated workmen from abroad. If we could have schools that would qualify pupils in textile skill, a very considerable advantage would be gained by all branches of the industry. We always give preference to graduates of technical schools. To be a successful weaver a knowledge of fibers and filaments is necessary, as well as a knowledge of loom construction. In like manner a dyer must have a practical knowledge of physics and chemistry. It is the lack of this technical knowledge among factory employees that keeps them at the same occupation from one generation to another, and we have ourselves to blame for not advancing in the arts and sciences.

The statement of the manager of the cotton factory is as follows:

During the twenty-eight years that I have had the management of cotton factories I have never found any benefit from employing foremen who had been educated in technical schools. A good foreman is improved by taking a course in a technical school, but he must be a good foreman first. The theoretical instruction given in such schools is beneficial in so far as it enlarges the scope of the student's knowledge. Textile schools are only of benefit when used for the purpose of improving and not for making mechanics or foremen. The only technical school I know of in this section has been the subject of many unfavorable criticisms from manufacturers because of the foolish notion that the graduates have regarding their ability. After spending a few years in the school these young men imagine that they are competent engineers, although they have never worked a day in a shop, and consequently know nothing about the routine of shop work, or everyday practice. I am strongly of the opinion that no young man should be admitted into the mechanical department of a textile or technical school until he has first served an apprenticeship in some shop. In the manufacture of cotton goods the dyers and finishers are the workmen who would be most benefited by technical training. But in all large

concerns it is customary to employ a trained chemist, who usually supplies the technical knowledge required by the foreman, who in turn simply carries out his instructions.

The attitude of the labor unions in the Dominion of Canada on the subject of industrial, trade, and technical education is shown by the following resolution, which was adopted in September, 1900, by the Trades and Labor Council of the city of Toronto and approved by the Trades and Labor Congress of Canada:

"Whereas the Toronto Trades and Labor Council, composed of delegates representing 50 organizations of the various trades and callings of the city of Toronto, and the Trades and Labor Congress of Canada, representing the workers in general of the whole Dominion, have always supported and are in favor of technical schools, the purpose of which is the training and education of artisans, mechanics, and wage-workers generally in such subjects as will promote a technical knowledge of mechanical and manufacturing arts, and affording such instruction in those branches of science and applied art as is required by the various industrial pursuits of the masses of the people, and especially calculated to benefit those engaged in the manufacturing industries or artisan occupations:

"*Be it resolved*, That the Toronto Trades and Labor Council and the Trades and Labor Congress of Canada have always been and are still opposed to the introduction into our public educational institutions of any system of industrial or manual training wherein is taught the use of tools used in the trades, or which embraces the imparting of practical knowledge of such trades to the pupils of such institutions, inasmuch as we regard such systems as a serious menace to the interests of the already underpaid and generally handicapped mechanic, and believe that such innovation would still further endanger the position at present occupied by the skilled worker in his efforts to better his condition. We believe that the partially-trained mechanics under the industrial or manual training system would be used against the skilled workers at the pleasure of the employer. We believe, also, that this "hothouse" training would be detrimental to the pupils themselves, inasmuch as the partial knowledge they would gain would prove a restraint to their ambition in some other direction, for which they might, by nature, be better adapted. Furthermore, we believe that the time that the wage-earner can usually allow for his children to attend school is no more than sufficient for them to acquire an ordinary education, without devoting any of such time to the study of things which may not be of any use to them in after years in the battle of life.

CHAPTER VI.

TRADE AND TECHNICAL EDUCATION IN FRANCE.

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INTRODUCTION.

The practice of the handicraft trades in France was formerly regulated by the trade guilds, which were very exacting as regards the duties and obligations of their members. Under the guild system each trade was divided into three classes—masters, journeymen, and apprentices. Each class was governed by definite regulations which were rigorously enforced. A journeyman could not become master unless he fulfilled certain requirements which called for great skill, long labor, and heavy outlay of money. Apprenticeship was severe and lasted for a long term of years, but the instruction given by the master had to be thorough and to cover the trade in its entirety. The number of apprentices was limited, each master in most trades being allowed but one apprentice in addition to his own sons. The guilds enjoyed an absolute monopoly in nearly every branch of industry, but in return for the privileges they were allowed to exercise they gave a guaranty of perfect workmanship.

This system remained in vogue for several centuries, but the power of the guilds was greatly restricted by royal order in 1776 because of abuses that had crept in. After a few months all the former privileges were regained, but in 1791 the guilds were definitely abolished by the constituent assembly. Under the act of the assembly every person was given the liberty to apply himself to whatever art or craft he desired provided he received a license and conformed to certain regulations. This act seriously interfered with apprenticeship. The rigid discipline with which it had formerly been regulated could no longer be made effective and in consequence a deterioration was soon noticed in the work of artisans.

About this time there began the great industrial changes which terminated in the introduction of machine methods and specialization of work. After the guilds were abolished a great number of independent producers entered the markets, foreign competition became a factor to be dealt with, and, finally, in order to retain custom, it became necessary to resort to the manufacture of cheap, salable articles. This

naturally brought about a change whereby instead of one man making a complete article he worked upon a particular part of it. After years of practice he became very rapid and proficient in his special line of work, but entirely lacked the knowledge and ability to produce the other parts. He was simply a specialized laborer. This change to machine methods is usually regarded as being the main cause of the final break-up of the old-time apprenticeship system.

After the introduction of the new system the old artisans gradually disappeared, and to take their place there remained only those whose training was merely mechanical. The deterioration of the workmen eventually became so pronounced that many attempts were made either to restore the guild system or to substitute another that would serve the purpose. All such attempts, however, resulted in failure. New conditions had arisen, and they required new remedies.

Private initiative first adopted the use of new palliative measures for the relief of the industrial disorders in France. Among the first to foresee the impending change and to realize the effect it would have upon the industrial affairs of the nation was the Duke de la Rochefoucauld, a colonel of cavalry, who during certain travels in Switzerland learned of a school that had been founded by St. Francis de Sales, in 1599. The peculiar feature of this institution was that it had maintained a section for industrial education. The Duke was so favorably impressed by this feature that he determined to establish a similar institution in France. Following up this determination he founded at his own expense an institution in which the sons of suboffícers of his regiment could receive a general elementary instruction and also pursue an apprenticeship in certain ordinary trades. This was the first institution for special trade instruction established in France. It was declared a national school by the first republic in 1799, and at a later date was converted into a school for the training of foremen. This institution was the forerunner of the schools of arts and trades. It was followed by other Government institutions of similar character, but in all the earlier Government schools the technical instruction was placed upon a plane above the requirements and abilities of the ordinary artisan.

Although the Government began at this early date to provide facilities for higher technical instruction, it was not until the last third of the nineteenth century that it turned its attention seriously to the task of providing for the technical training of ordinary workmen. This had always been considered the province of the communes, departments, and private bodies. Local needs, it was thought, could be best realized and provided for by those more in touch with conditions existing in their respective localities. Various bodies, in time, took up the task each in its own way and for this reason the develop-

ment in France of institutions for giving trade and technical instruction has proceeded along a number of more or less independent lines.

At present there is an elaborate system of trade and technical schools organized and controlled by the Government; of schools maintained by the departmental and municipal authorities; and of schools operated under the auspices of private individuals and private bodies, such as trade organizations, employers' associations, stock companies, religious organizations, etc. As a general rule this development of institutions through so many independent initiatives has caused very little duplication.

The institutions maintained by the Government are only to a limited extent special trade schools which prepare students for particular definite occupations. The main purpose in most of them is to provide facilities for giving a broad industrial training which combines a thorough course of scientific and technical study with enough practical work to render students expecting to enter the handicrafts or factory work familiar with the manual operations of the various trades. The schools are in most cases excellently equipped with shops for the practice of the principal metal and wood working trades.

The task of founding special schools for education purely of a trade character or instruction in respect to highly specialized branches of industrial work has, as a rule, been left to local governments and private bodies or individuals, although the Government has encouraged their efforts in various ways, and in many cases has assisted in the maintenance of their schools through the grant of annual subsidies. Great liberality has been exhibited by the Government in this respect. While there were but 48 institutions receiving financial aid from the ministry of commerce in 1880, their number in 1900 was 292 or over six times as great as in the former year.

It would be interesting to trace the history of technical education along each of the different lines upon which it has been developed, but this would be beyond the province of the present report.

Perhaps the most interesting feature in the development of the complex system of technical schools in France is the direct and active part taken by the Government. It is, therefore, considered best to relate in some detail the most important steps that have been taken in the matter by the Government. Some of the most important facts connected with the establishment of schools by societies, organizations, municipalities, etc., will, however, be presented in the proper place by way of explanation.

It has been seen that the Government began the work of providing facilities for trade and technical education with the conversion of the private school of the Duke de la Rochefoucauld into a national institution in 1799. It is said that this institution was used for a while as a

military school, but its industrial character was soon restored. A similar institution was created by the Government in 1804, but despite this early beginning the definite rounding out of a logical system of State schools for trade and technical education was not accomplished until the year 1900.

In France, as in most other countries, it was impracticable to outline in advance a comprehensive system. One school after another was established by the State when the need became particularly urgent. The result was that while adequate provision was made in some directions other fields were wholly neglected. Schools were organized without any particular effort to establish a definite relationship between them. Even the matter of control and supervision was not on a logical basis. As these schools became more numerous, however, and the importance of technical education was better appreciated, the necessity for bringing the various institutions under a general system was recognized, and by a series of laws and administrative orders, the last of which bears the date of April 13, 1900, this was finally accomplished. France to-day possesses a remarkably complete system of trade and technical schools, operating under public auspices, for furnishing technical education in all grades, from the teaching of the simple operations of ordinary trades to the training of engineers for the most advanced scientific and technical work.

It is of interest to trace briefly the different steps by which this result was accomplished. As the history of the state system of technical schools is to a considerable extent intermingled with that of public instruction—at least in so far as regards legislation and decrees concerning particular grades of instruction—it is deemed advisable to present a few of the main facts relating to the development of the public-school system in France.

Public-school education in France practically dates from the efforts of M. Guizot in its behalf in 1833. In that year he secured the enactment of a law making it compulsory upon every commune in France to establish a public school. Primary education was at the same time divided into two grades—elementary and superior. The elementary primary schools corresponded approximately to the grade schools in the United States, and the superior primary schools to the high schools. Pupils entered the latter after they had been graduated from the elementary schools at 13 years of age, and remained until the age of 16 or 17.

In 1850 the superior primary schools were abolished, as for various reasons they had not been successful. In 1881, however, they were revived and have since undergone a great development and at present constitute a very important part of the public-school system of the country.

An act passed June 16, 1881, made primary education absolutely free, and an act of March 28, 1882, made attendance at school com-

pulsory for children between the ages of 6 and 13 years, and public education was given a purely secular character. By a law of October 30, 1886, public primary education was definitely organized in its various grades and intrusted exclusively to the laity.

It was not until a general system of public primary education had been definitely established that the French Government began seriously to concern itself with the subject of primary trade and technical education. In 1862 M. Rouland, minister of public instruction, appointed a commission to make an investigation concerning commercial, industrial, and agricultural instruction in public and private educational institutions. His successor, M. Duruy, continued and enlarged the scope of this inquiry. The commission visited institutions in Germany, Belgium, and England and made a very interesting report, which indicated the urgent necessity of devising some system of trade training to take the place of the apprenticeship system which was rapidly sinking into decay. No immediate action, however, resulted.

A new impetus was given to the movement by the showing made at the Paris Exposition of 1878, and that year may be taken as the starting point of the modern movement to establish a system of public trade and technical schools of a primary grade in France.

The country generally became interested in the question, and various public bodies urged the Government to take action. After considering and rejecting a proposition which provided for the establishment by the state of a technical school in each department, a plan was accepted which made provision for grafting technical instruction upon existing primary schools. This plan was legally adopted in the law of December 11, 1880.

This law was intended to facilitate the founding of special schools by minor public bodies and thus to lay the foundation of public technical education of a primary grade. The result of the law was to give rise to a new order of institutions known as manual apprenticeship schools, under which title were grouped (1) existing apprenticeship schools founded by communes or departments, and (2) advanced primary schools which gave considerable attention to technical training. The purpose of the new class of schools was to provide general technical instruction and to develop manual dexterity in youths destined for manual trades. Nothing like apprenticeship to any particular trade was contemplated, however. Both the foregoing classes of schools were placed under the category of "primary schools," and the expenditures for their maintenance were made obligatory on the departments and communes. By this law the manual apprenticeship schools and advanced primary schools that fulfilled the requirements as to technical instruction were placed to a certain extent under the control of the ministry of public instruction and fine arts and the ministry of agriculture and commerce.

As a result of an administrative order of July 30, 1881, which practically nullified the law, not a single manual apprenticeship school was founded by a department or commune during the period from 1880 to 1888. The superior primary schools giving attention to industrial training, however, received a considerable development.

One result of the law of December 11, 1880, was the establishment by the Government of the three national trade schools of Armentières, Vierzon, and Voiron. These were intended to serve as models for the new institutions which it was hoped to call into existence. Another school of the same character was opened at Nantes at a later date.

The unsatisfactory working of the law of 1880, in respect to its failure to induce the founding of manual apprenticeship schools, led to the appointment in 1886 of a commission to investigate the subject and propose reforms. The outcome of this inquiry was the promulgation of an official order, dated March 17, 1888, which was intended to put an end to the existing confusion regarding the relative spheres of the two ministries in the management of the manual apprenticeship schools, that having been the main cause of the failure of the law of 1880. This order defined the form of government of these schools, their programme of studies, conditions of entrance, etc. It also placed them definitely under the joint control of the two ministries mentioned. The order remained in force until 1892, in so far as the manual apprenticeship schools were concerned.

In the meantime, by law of July 21, 1891, the National Practical School for Workmen and Foremen was established at Cluny. The reason for the establishment of this institution, which occupies a unique place in the scheme of government schools, was the feeling that the national schools of arts and trades did not reach the workmen and were useful only for training managers and directors, and that provision should be made for preparing competent foremen and subdirectors.

While the order of March 17, 1888, undoubtedly accomplished some good, it but partially met the necessities of the situation. During the period from 1888 to 1892, 59 advanced primary schools had conformed to the provisions of the law of December 11, 1880, and the order of March 17, 1888. The development of technical instruction in advanced primary schools was the most important result of the law of December 11, 1880, for by that result the foundation was laid for the very important class of institutions known as practical schools of commerce and industry. During the four-year period referred to it was demonstrated that the scheme of organization, as provided for in the law of 1880 and the order of March 17, 1888, did not meet the requirements of the situation.

In addition to the inconveniences arising from a joint control by two ministries with the attendant confusion of aims and purposes, it was

finally realized that the technical instruction as given in the manual apprenticeship and assimilated schools did not produce the results that were desired.

Heretofore industrial education had been considered more in the nature of a complement of primary instruction than as a preparation for real work. It became evident that a change in control, as well as in the organization of schools for primary technical instruction, was necessary if any practical advantages were to be derived from them. This change was accomplished in 1892. By a section inserted in the financial law of January 26 of that year, it was provided that henceforth the advanced primary schools in which the instruction was largely of an industrial and commercial character should be exclusively under the authority of the ministry of commerce and industry, and that the class should take the general name of "practical schools of commerce and industry" (*écoles pratiques de commerce et d'industrie*).

The ministry of commerce and industry was at the same time given the authority to sanction the transformation of ordinary superior primary schools into practical schools of commerce and industry, or to authorize the founding of new institutions of this class wherever necessary. In these schools the importance of technical instruction is fully realized, and it is given a relatively large share of the total time.

One can hardly overstate the importance of the reform accomplished by this law. For the first time France was given a system of primary trade and technical schools under Government auspices whose chief aim was industrial instruction, and whose work was supervised by the department having to do with trade and industry rather than education.

This policy of intrusting to the ministry of commerce and industry all schools for the provision of commercial and industrial education was further carried out by the financial law of April 13, 1900, which placed under the supervision of this department the four national trade schools of Armentières, Nantes, Vierzon, and Voiron.

The same process of intrusting the direction and supervision of schools to the department having charge of those fields to which the instruction relates rather than to a single authority in the person of the minister of public instruction has been logically carried out in respect to all the other classes of scholastic institutions, so that each of the ministries now has exclusive control of schools that give special instruction in matters coming within the sphere of its activities. All those schools that come within the scope of the present report are under the jurisdiction of three ministries, that of commerce and industry, that of public instruction and fine arts, and that of public works.

By far the largest number of the Government schools and schools under Government supervision, with which this report is concerned, are under the supervision and direction of the ministry of commerce

and industry. Under this ministry are included all the State technical and trade schools proper, except those having to do with the teaching of mining and decorative or industrial art.

In the following enumeration of schools, falling under the spheres of the several ministries, mention of a large number of institutions which belong to classes not considered in this report is avoided as far as possible, as such enumeration would serve no useful purpose. Private, departmental, communal, and other institutions that receive State aid are also brought more or less under the influence of one or the other ministries. The schools under each ministry are as follows:

Ministry of commerce and industry: (1) National Conservatory of Arts and Trades, at Paris. (2) Central School of Arts and Manufactures, at Paris. (3) Four national schools of arts and trades, at Aix, Angers, Châlons-sur-Marne, and Lisle. (4) National Practical School for Workmen and Foremen, at Cluny. (5) National Apprenticeship School, at Dellys (Algeria). (6) Two national schools of watchmaking, at Cluses and Besançon. (7) Four national trade schools, at Armentières, Nantes, Vierzon, and Voiron. (8) Thirty-four practical schools of commerce and industry, which, although being departmental and communal institutions, are so thoroughly under State control and supervision that they are included in this list. They are separable into three categories—(a) Sixteen practical schools of industry, located at Boulogne-sur-Mer, Brest, Firminy, Havre, Lisle, Marseille, Montbéliard, Morez, Pont-de-Beauvoisin, Rennes, Romans, Rouen, Saint-Chamond, Saint-Didier-la-Séauve, Saint-Etienne, and Vienne; (b) two practical schools of commerce (not considered in the present report), located at Boulogne-sur-Mer and Narbonne; (c) sixteen practical schools of commerce and industry, of which ten are for males and six for females. The schools for males are located at Agen, Béziers, Cette, Fourmies, Grenoble,[a] Limoges, Le Mans, Mazamet, Nîmes, and Reims; those for females are located at Boulogne-sur-Mer, Havre, Marseille, Nantes, Rouen, and Saint-Etienne.

Aside from the State schools, a very large number of institutions, including municipal, communal, departmental, and private schools for purely trade and technical instruction, are subsidized by the Government and placed under the supervision of this department.

Ministry of public instruction and fine arts: The only State institutions under this ministry with which this report is concerned are those for teaching decorative or industrial art. They are: National School of Arts applied to Industry, at Bourges; four national schools of decorative art at Aubusson, Limoges, Nice, and Paris; National School of Industrial Arts, at Roubaix; and School of Ceramics attached to the National Manufactory, at Sevres.

[a] This school also contains a division of agriculture.

Besides these State institutions a number of municipal, departmental, and communal schools of decorative and industrial art which receive subsidies from the State are placed under this ministry.

Ministry of public works: Only a few schools have been placed under this ministry and they are: School of Roads and Bridges and School of Mines, at Paris, both of which are recruited from graduates of the polytechnic school; School of Mines, at Saint-Etienne; and schools for mine bosses and foremen, at Alais and Douai. The two latter are the only institutions under this ministry that properly come within the scope of this report.

The National Government has, as already stated, thought it advisable to leave the establishment of schools for what is termed the primary grade of technical instruction to the minor public authorities and to private initiative. As a result there have arisen a large number of trade schools, continuation schools, trade courses, etc., which are maintained by local governments, by trade unions, by employers' associations, by religious orders, by societies, etc.

These institutions in a large measure are meant to serve a more specific purpose as regards the preparation of students for particular trades, or their improvement therein, than are the national schools. The trade schools proper, for instance, in most cases aim to give the student a complete training in the manual operations of a trade—in other words, to serve the purpose of an apprenticeship. They are, without exception, intended to fill certain definite needs of the localities in which they are situated.

Aside from the practical schools of commerce and industry the departments and communes maintain comparatively few trade or industrial schools. Neither do municipalities as a rule, but each class of local governments pays considerable attention to industrial drawing. Their schools are generally subsidized by the State, in which case a general supervision is exercised by the central Government. About forty superior primary schools that carry industrial courses have not as yet received sufficient development in a technical direction to bring them within the jurisdiction of the ministry of commerce and industry under the new arrangement. The tendency, however, is toward the transformation of all such schools into "practical schools."

The only system of municipal schools that requires special mention is that of Paris. For a number of years the municipal authorities have displayed great energy in providing model institutions for trade and technical education. They have spared no expense in the matters of buildings, equipment, and teaching personnel, and as a result, Paris has at present the most progressive schools in France for the primary grade of trade instruction.

The motives for the efforts of the municipality in this direction are the same as those which actuated the central Government. Nowhere in

France was the breakdown of the apprenticeship system and the results of specialization due to the introduction of new methods more severely felt than in Paris. The authorities turned their attention at an early date to experiments for ameliorating conditions arising from the lack of technical training. Various plans were tried, but no real success was gained until, in pursuance of a vote of the municipal council on May 27, 1872, a model school of apprenticeship in the wood and metal working trades was established directly by the city authorities. This institution, now known as the Diderot school, produced satisfactory results and it was followed by other municipal schools, for both males and females.

At present the city has two schools for wood and metal working, a school of furniture making, a school of industrial drawing, a school of industrial art, a school of physics and chemistry as applied to industry, and a school for the printing trades, all of which are for boys. For girls there have been established six schools in which are taught a variety of the trades for which women are adapted. They are schools for dressmaking, millinery, artificial-flower making, corset making, trade drawing, painting, etc.

Each of the Parisian schools has a supervisory committee appointed by the municipal council, composed of members of the council and a variable number of manufacturers or merchants who have a knowledge of the trades taught. One representative of the ministry of commerce and one from the ministry of public instruction are also placed on each committee. The powers of these committees are not defined by regulation, but they exercise general supervision over the direction and finances of the schools, being subject only to the veto power of the municipal council.

The number of institutions established by labor unions and employers' associations is very large and is rapidly increasing. The greater number of such institutions are evening technical, trade, and drawing schools. Most of them belong to the class known as continuation schools and courses, although there are a few genuine trade schools among them. They are found all over France, but are naturally more numerous in Paris than elsewhere. In this city they are usually limited to giving instruction in some particular trade or related group of trades pertaining to a single industry. Many of these institutions receive subsidies from the State, department, and municipality. Those that receive State subsidies must submit to the inspection established by the State. There are several private evening schools and classes, in and out of Paris, which have been founded by private societies (philomatic societies, philotechnic societies, etc.). Some societies maintain a very large number of courses for technical instruction in several industries.

In any account of industrial education in France prominent attention must be given to the work of various religious orders, particu-

larly that of the orders known as the Brothers of the Christian Schools (*Frères des Écoles Chrétiennes*) and the Salesian priests (*Prêtres Salésiens*).

The former of these orders was founded by Jean-Baptiste de la Salle (1651–1719). Its object, as the name implies, is educational. Until the early part of the nineteenth century the order concerned itself chiefly with the primary education of children of the working classes. At an early day, however, it recognized the need of commercial and industrial education, and began establishing schools for that purpose. No definite plan, however, in the organization of such schools is followed. Each school is provided with the programme that best meets the local needs. Among the schools directed by the brothers are found those in which theory predominates, others in which shopwork is given the larger share of the time, and still others which are merely preparatory to more advanced industrial schools. In the latter class of schools shopwork is almost entirely absent, merely enough time being devoted to it to enable students to discover their aptitudes and to facilitate their entrance into the higher schools.

In 1900 the Brothers of Christian Schools conducted 36 institutions in France in which industrial education was given a place. In only 7 of the 36 schools, however, are the aims and the character of the industrial instruction of such nature as to bring them within the lines of this report.

The Salesian Priests is the name given to an order founded by Don Bosco in 1857. The order originated in Italy, but at present it directs educational institutions in various European countries. In 1875 the order established its first trade school in France, at Nice, and eight others have been established at various places since that date. Only five of these schools come within the scope of this report. The instruction in the other four relates to agriculture, etc. These schools do not present the same diversity of organization as is shown in those directed by the Brothers of Christian Schools. Their purpose is generally more specific. Those in which the instruction is of a trade character prepare students for entering directly upon industrial work upon leaving the schools, that is, they aim to produce skilled workmen.

Of three or four other orders, each maintains a regular trade school. A few congregational schools fulfill more or less completely the requirements of an industrial school as the term is defined in this chapter.

An elaborate system of administration and inspection of the State and subsidized schools has been provided in numerous laws and decrees. The principal features of the general system of administration and inspection of those schools which come under the direction or supervision of the ministry of commerce and industry are as follows: At the head of the entire system is the minister of commerce and industry, who is the final authority in all matters relating to the schools. He is assisted by two bodies whose functions are of a general nature.

They are the superior council on technical education and the committee of inspection.

The superior council on technical education was established by an imperial decree of March 19, 1870, but has been repeatedly reorganized since that date. At the present time it consists of 4 senators and 6 deputies; 8 divisional inspectors of technical instruction; 2 departmental inspectors of technical instruction; 6 representatives of chambers of commerce; 2 representatives of trade unions which have organized trade schools or courses; 2 representatives of employers' associations which have organized such schools or courses; 2 women representing the trade education of girls; 10 manufacturers, merchants, or publicists occupying themselves with the matter of trade education; 1 director of a national school of arts and trades; 1 director of a practical school of industry; 1 director of a practical school of commerce; and 2 directors of superior schools of commerce. The selection of these members is made by the minister of commerce and industry, and the term of office is four years. In addition to these members, who are appointed, the following persons are ex-officio members: The director of the teaching staff and accounts of technical instruction; the director of labor and industry; the director of the national conservatory of arts and trades; the director of the central school of arts and manufactures; the assistant director of technical education; the inspector-general of technical education; the inspector of the outside service of architecture; and the chief of the bureau of commercial education.

Within this council there is constituted a permanent council consisting of the ex-officio members and ten others designated by ministerial order.

The superior council is required to give its advice and opinion in all general questions pertaining to technical education which the minister may submit to it. In some cases its particular functions are defined in special regulations.

The committee of inspection is composed of the director of technical education, who acts as president; the inspector-general of technical education; the assistant director of technical education; the inspectors of practical schools of commerce and industry; the divisional inspectors, who have within the past two years been charged with special missions in relation to practical schools; and a chief of a bureau of the central administration, who acts as secretary. The functions of this committee are purely advisory and consultative.

The actual inspection service of technical education is vested in the following officials: The inspector-general; divisional inspectors; departmental inspectors; and inspectors of practical schools of commerce and industry.

The inspector-general is the administrative head of the inspection service. His authority extends over all the technical schools under

the ministry of commerce and industry. He is, however, specially charged with the inspection of the National Conservatory of Arts and Trades, the Central School of Arts and Manufactures, the national schools of arts and trades, the National Practical School for Workmen and Foremen at Cluny, and the national watchmaking schools at Cluses and Besançon.

Under the inspector-general are the divisional inspectors. These officers were first provided for in 1888, their functions then being to inspect the manual apprenticeship schools called forth under the law of December 11, 1880. At the present time their chief duties are to inspect the practical schools of commerce and industry and the superior commercial schools recognized by the Government, as well as private institutions receiving State aid. They also undertake special studies or inquiries.

The departmental inspectors assume the frequent inspection of the practical schools of industry and commerce in their department and the private technical schools and courses receiving encouragement from the department. These inspectors are selected from among the chief manufacturers of each district, and serve without remuneration.

The inspectors of the practical schools of commerce and industry devote their attention to that class of schools and also have charge of the organization of post-graduate work.

A similar system of supervision and inspection is provided for the schools which are under the jurisdiction of the ministry of public instruction and fine arts.

CLASSES OF INSTITUTIONS.

There is no general classification of all the schools of public or private character in any of the later French reports. An examination of individual schools, however, shows that a general classification is feasible. The classification is necessarily incomplete in some respects and in some instances is rather arbitrarily made. It was not possible to secure direct information from every institution in a field so large; hence, recourse has been had to the descriptions contained in recent reports issued by the French Government for much of the information upon which this classification is based. In a few instances there has been considerable doubt as to what disposition to make of the school, especially when its character is mixed, as in the case of schools in which the instruction is partly industrial and partly in relation to art. Each institution has been placed, however, with as much accuracy as the information at hand would allow.

Each class into which the schools have been separated is briefly defined, so that the reasons for placing particular schools in one or another class may be seen. The general distinctions drawn between classes are well marked. Although some institutions have been classed

as schools for advanced industrial education, the classification is not, as a rule, based upon the grades of general instruction to which that given in these schools corresponds, but rather upon the schemes of organization presented by and the purposes to be subserved in the individual schools. Thus a primary and a somewhat more advanced grade of schools may occasionally be found in the same class.

The following types of institutions for trade and technical instruction are to be found in France:

1. Schools for advanced industrial education.
2. Schools for decorative and industrial art.
3. Practical schools of commerce and industry.
4. National trade schools.
5. Trade schools for several trades.
6. Trade schools for single trades.
7. General industrial schools.
8. Trade and technical continuation schools and courses.
9. Industrial drawing schools.

This classification will be found to include, under one head or another, every French institution which properly deserves consideration in this report. In some classes, especially those containing the trade schools proper, there will be found considerable variety of organization as regards the amount of practical work required and the degree to which the technical instruction is carried. In the pages following the principal characteristics of each class of institutions will be briefly mentioned.

SCHOOLS FOR ADVANCED INDUSTRIAL EDUCATION.

This class includes a number of institutions in which the instruction corresponds to the secondary and superior grades obtaining in other educational institutions. The following institutions are included in the class:

National institutions: Conservatory of Arts and Trades, at Paris; Central School of Arts and Manufactures, at Paris; national schools of mines, at Paris and Saint-Etienne; National School of Roads and Bridges, at Paris; four national schools of arts and trades, at Aix, Angers, Châlons-sur-Marne, and Lisle; National Practical School for Workmen and Foremen, at Cluny.

Other public schools: Electro-technic Institute, annexed to the University, at Nancy; Industrial Institute of Northern France (departmental), at Lisle.

Private schools: Central School (maintained by a stock company), at Lyon; Catholic School of Higher Industrial Studies, at Lisle; Technical Institute (Catholic; maintained by a stock company), at Roubaix; Catholic Institute of Arts and Trades, at Lisle.

Many of these institutions are beyond the limits of this report, but most of them are, however, briefly mentioned in the general statements which follow.

The Conservatory of Arts and Trades, at Paris, is an institution originally intended as a repository of machinery, models, designs, descriptions of machinery and mechanical appliances, technical volumes, etc., but its field has been enlarged by the provision of facilities for advanced scientific study in connection with various lines of industry. It possesses laboratories for original research in mechanics, physics, and chemistry applied to various industries, electricity, etc., and offers a series of free lecture courses. It has no definite curriculum, but rather constitutes an institution that offers advantages to students making special investigations in matters connected with some line of industrial or agricultural work, etc.

The Central School of Arts and Manufactures, at Paris, has a more definite organization than that of the Conservatory. Its purpose is to form engineers of the highest grades in all branches of industry. It is at present installed in quarters which were built for it at a total expense of 10,788,860 francs ($2,082,250). The professions specially prepared for are civil and mechanical engineering, metallurgy, and industrial chemistry. About 240 new students are admitted each year. Entrance is secured through competitive examination. The duration of the courses is three years. French students who are recognized as specially qualified for the military service are given a complete military instruction. On the theory that no matter what profession students intend to follow they have need of certain general scientific training, all the students follow the same courses during the first two years. Specialization begins only with the third year. Since the organization of the school in 1829, through the school year 1898–99, a total of 7,950 students were granted diplomas or certificates of capacity.

The national schools of arts and trades form a class immediately below that of the Central School of Arts and Manufactures. This class of institutions originated from the conversion of the Duke de la Rochefoucauld's private school into a national institution, which became the first school of arts and trades, and after several removals was finally located at Châlons-sur-Marne. In 1803 a second school, fashioned after the model of the first, was founded at Beaupréau, and was afterwards removed to Angers. In 1843 a third school was opened at Aix, and in 1881 it was decided to establish a fourth at Lisle. The last-named school, however, was not formally opened until October, 1900.

These four schools are organized according to the same general plan. They cover the same ground and are governed by the same rules, etc. The school at Lisle, however, has a division devoted to spinning and

weaving, in which students who have completed their term of studies in any of the national schools of arts and trades may devote an extra year to this one branch of industry. The school at Châlons-sur-Marne is described in detail in another place. The description of that school will apply to all, with the exception noted in regard to the weaving division of the school at Lisle.

These institutions have outgrown their original purpose. The character of the theoretical instruction has become much broader and more highly developed during recent years, so that instead of training pupils for entering actual, definite trades as workmen who may be developed into foremen, the present level of the theoretical instruction is much superior to that required, or that which is particularly to be desired, for artisans and foremen. It is intended for a higher class of workmen, such as future managers, directors, and even manufacturers.

This result has been brought about in part by the effort to keep pace with industrial progress, and in part from the fact that pressure for appointments has made it necessary to raise the entrance qualifications and therefore the character of the instruction. On the other hand, while the practical work is present in such nature and amount as to almost serve as an apprenticeship, it is not really intended to do so. The aim is to devote enough attention to practical work to make the future directors of industrial enterprise thoroughly familiar with all the operations they may be called upon to superintend.

Graduates are advised, however, to complete their practical training by serving a certain time in an industrial establishment in the capacity of ordinary workmen. Their school training is said to be sufficient to enable them to earn journeymen's wages after a little shop-practice. The Government encourages this practice by granting premiums of 500 francs ($96.50) each to a certain class of graduates who, within two years after graduation (time for military service omitted), can prove that they have served one entire year in an industrial establishment. Accommodations are provided for about 1,200 students in the four schools. This allows about 400 appointments each year, provided each pupil remains the full term of three years. To show the great competition for appointment it is stated that for 300 vacancies existing in three schools in 1899 there were 1,348 candidates.

The National Practical School for Workmen and Foremen at Cluny occupies a position subordinate to the schools of arts and trades. Its mission is to produce highly skilled workmen who may become foremen in the wood and metal industries. It occupies a place similar to that formerly held by the schools of arts and trades. The school is fully described in another place.

The Electro-technic Institute, at Nancy, is a school for training the highest class of electrical workers. The course of study covers three years, two of which are devoted to general studies of a theoretical

and practical nature. The third year is devoted entirely to technical instruction.

The Industrial Institute of Northern France, situated at Lisle, is intended to educate mechanical engineers, electricians, and chemists. It is briefly described in the account of individual schools.

The Central School of Lyon is an institution modeled after the Central School of Arts and Manufactures of Paris. It is owned by a stock company, but receives a small subsidy from the department of the Rhône. The institution is not nearly so important as its prototype. Only about 80 students were in attendance in 1900. The regular course of study covers three years. There is no specialization.

The School of Higher Industrial Studies, annexed to the Catholic University at Lisle, is an institution bearing some resemblance in many points to the Central School of Arts and Manufactures, but the technical instruction is not of such a high character. It is solely concerned in the education of manufacturers' sons, those who in the future are to assume the responsibility of managing industrial establishments. The diploma of civil engineer is awarded to pupils who remain at the school three years and pass the required examinations. Students who remain but two years are awarded certificates if they pass the examination. There is no specialization in the school.

The Technical Institute at Roubaix is a private school under Catholic direction, and is intended to develop managers of the various departments in the textile manufactories. A full description of this institution is to be found in the section devoted to the description of individual schools.

The Catholic Institute of Arts and Trades was created in 1898 at Lisle. It follows in a general way the model of the national schools of arts and trades.

SCHOOLS FOR DECORATIVE AND INDUSTRIAL ART.

In addition to schools of fine arts, France possesses several schools for the teaching of decorative or industrial art. As previously stated, such schools come under the authority of the ministry of public instruction when maintained or subsidized by the State.

In 1897 M. Marius Vachon made a report (a) on the art industries and schools of industrial art in France. He found very few schools that fulfilled expectations in regard to the teaching of art from the standpoint of its industrial application. In most instances the tendency seemed to be in the direction of pure art, the pupils being more concerned in preparing for the great art schools of Paris or other cities than in the study of art as applied to industry. The organization of the instruction in many schools favored this tendency.

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a Les Industries d'Art, Les Écoles et les Musées d'Art Industriel en France (Départements).

The State schools of industrial or decorative art are: The National School of Arts applied to Industry, at Bourges; the national schools of decorative art, at Paris, Limoges, Aubusson, and Nice; the National School of Industrial Arts, at Roubaix, and the School of Ceramics attached to the national manufactory at Sevres.

Several schools have been established by minor public authorities (municipalities, communes, etc.). The most important are: The Bernard-Palissy School of Industrial Art (municipal), at Paris; the art departments of the Municipal Academic School, at Douai; the Municipal and District School of Fine Arts, at Nancy; the District School of Industrial Art, at Saint-Etienne; the School of Industrial Art, at Calais; the art department of the School of Fine Arts and the Industrial Sciences, at Toulouse; the District School of Fine Arts, at Rennes; the School of Fine Arts, at Marseille; the School of Fine and Decorative Arts, at Bordeaux; and the School of Fine Arts, at Lisle. A few of these schools are described in the proper place.

PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY.

By far the most important class of institutions for the provision of practical industrial training coming under governmental control are those known under the collective designation of practical schools of commerce and industry. The history of the building up of this system of schools has been given in the introductory pages. As these schools are all subject to the same general regulations, and the character of their instruction, in spite of individual differences, is so largely the same, a general account of the class as a whole will be of interest.

In a circular addressed to the prefects of the departments, under date of June 20, 1893, the minister took occasion to define accurately the character it was desired to give to the new schools. Some of the more important passages of the circular are here reproduced.

Their purpose is to prepare commercial employees and artisans who can be immediately utilized in the counting room and in the shop. The advantages of a general education are not for a moment to be denied. It constitutes the solid base which increases the value of the man and renders more profitable the trade knowledge which he has acquired. Such instruction, therefore, must not be proscribed in the practical schools. The students will necessarily there receive a complementary primary instruction, and they will not moreover be admitted unless they have fulfilled the obligation imposed by the law of March 28, 1882. [Compulsory attendance at school between the ages of 6 and 13.] * * * Industry has undergone a profound transformation. Everything is sacrificed to the end to be attained, which is to produce quickly and cheaply; and in consequence of the division of labor and the employment of machinery, apprenticeship in the shops exists to-day only in exceptional cases. Never, however, in consequence of the frequent changes which must be introduced in the

equipment of plants, has the necessity for men possessing sufficient theoretical knowledge, and accustomed to the practice of the shop, been more clearly demonstrated. * * * It has become absolutely essential to place at the disposal of our merchants well-prepared assistants, and of our manufacturers high-class workmen. It is to the practical school that falls the duty of meeting this obligation.

Practical schools of commerce and industry may be established either by a department or a commune, or by several departments or communes acting together. It is not necessary that the school shall be a new organization. It may result from the transformation of an existing superior primary school. These schools may differ in respect to whether they are for boys or for girls, or whether they prepare primarily for commerce or for industry or for both. On January 1, 1901, there were in existence a total of 34 practical schools of commerce and industry. Of these, 6 are for girls and 28 for boys. Of the boys' schools, 16 are for industry only, 9 have departments for both industry and commerce, 2 are for commerce only, and 1—that of Grenoble—departments for industry, commerce, and agriculture. Of the girls' schools, all are for both industry and commerce.

It will be seen from the list of schools that has been given on page 710 that nearly every important city of the Republic has its school of industry or of commerce and industry. In a number of cities, namely, at Havre, Saint-Etienne, Rouen, and Marseille, there are two schools, one for boys and one for girls. One city, Boulogne-sur-Mer, has three schools.

The general system of State supervision of these schools has already been explained. A few words should be said regarding the method of their local administration, as in spite of the Government control the schools are departmental or communal institutions.

For each practical school of commerce and industry there must be an improvement council (*conseil de perfectionnement*), the duty of which is to exercise a general oversight of the school. This council consists of the prefect or mayor, according to whether the school is a departmental or communal one, the inspector of commercial or of industrial instruction, a member designated by the minister of commerce, and 4 members appointed by the general [departmental] council or the communal council, 2 of whom must exercise, or have exercised, an industrial or commercial calling, according to whether the school is an industrial or commercial school. If it is both commercial and industrial, both the inspector of commercial and the inspector of industrial instruction must be members. In this case also the minister designates 2 persons, and 6 others are elected by the council. If the school is one for girls, 2 of the elected members must be women.

The director of the school must take part at all the meetings of the council. The council has as its particular functions to assist at the

entrance examination, to visit the school at least once a month, to pass upon the annual report of the director, to look after the securing of positions for the graduates, to give its advice when requested by the administration, and to make such suggestions as it deems proper.

Tuition in these schools is free. The expenses of the schools are borne partly by the departments and communes, and partly by the central Government. The problem of finding suitable instructors in the purely technical courses of these schools was met in the case of the practical schools of industry or industrial departments by organizing a normal course in the National School of Arts and Trades at Châlons-sur-Marne. This course, indeed, antedates the formal establishment of the practical schools of indu-try and commerce, having been organized in 1891 for the preparation of teachers for the superior primary schools, giving special attention to industrial education. It has prepared 37 teachers during the period 1891 to 1899.

Teachers for the commercial courses have been trained in normal courses in the higher commercial schools at Paris and Lyon. The normal course at Lyon was discontinued in 1899, and one in the practical school at Havre will in future serve for the preparation of teachers for both departments of the practical schools for girls. A total of 52 teachers have been prepared in the normal courses attached to the superior commercial schools and the practical school at Havre.

The conditions of admission to the practical schools are the same for all the institutions. Candidates must be at least 12 years of age. If they are under 13 years they must be provided with a certificate of primary instruction; if over that age they must pass an examination when not provided with such a certificate. If there are more candidates than there are places, a selection is made through a competitive examination. In principle the schools are intended for day pupils, though in a few cases where the practical school has resulted from the transformation of a primary boarding school it has been allowed to retain the boarding-school feature after the transformation. In some cases also a boarding department has been specially organized to acommodate pupils from a distance.

The course of studies is in general three years, with the exception that in some of the schools, notably in those of Saint-Etienne and Grenoble, a fourth year has been added. In some cases, also, a preparatory course has been organized.

In general, the scheme of instruction for each school is worked out by the supervisory council of the school, though certain lines have to be adhered to. The minister of commerce has prepared schemes of study which are believed to show the most desirable apportionment of the time of the students. These model programmes are reproduced below. It is to be understood that their adoption is not obliga-

tory upon the schools, but are merely types or models which are to serve as a guide to the officers of the schools in organizing their courses and are presented here as giving the best general idea of the character of the schools as a whole.

MODEL PROGRAMME OF STUDIES AND HOURS PER WEEK DEVOTED TO EACH, PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY.

PRACTICAL SCHOOLS OF INDUSTRY: BOYS.

Studies.	Number of hours per week.		
	First year.	Second year.	Third year.
INDUSTRIAL INSTRUCTION.			
Shopwork	30	30	33
Drawing	6	6	6
Geometry	1½	1½	1½
Mechanics	.....	.....	1½
Industrial economy	.....	.....	1½
Total	37½	37½	43½
GENERAL INSTRUCTION.			
French language	3	3	1½
History	1½	1½	.....
Geography	1½	1½	.....
Natural history and hygiene	.....	1½	1½
Physics	1½	1½	.....
Chemistry	.....	1½	1½
Arithmetic	1½	1½	1½
Accounts	.....	.....	1½
Total	9	12	7½
Total hours of instruction	46½	49½	51
Hours of study	9	9	9

PRACTICAL SCHOOLS OF COMMERCE: BOYS.

Studies.	Number of hours per week.		
	First year.	Second year.	Third year.
COMMERCIAL INSTRUCTION.			
Commerce, accounts, and bookkeeping	6	6	6
Foreign languages	6	6	6
Arithmetic and algebra	3	3	3
Geography	1½	3	3
Writing, etc	3	1½	1½
Chemistry and study of commodities	1½	3	3
Legislation	.....	.....	3
Commercial economy	.....	.....	1½
Total	21	22½	27
GENERAL INSTRUCTION.			
French language	1½	3	3
Drawing	1½	1½	1½
History	1½	1½	.....
Natural history and hygiene	.....	1½	.....
Geometry	.....	1½	1½
Elements of physics	1½	.....	.....
Total	9	9	6
Total hours of instruction	30	31½	33
Hours of study	9	9	9

MODEL PROGRAMME OF STUDIES AND HOURS PER WEEK DEVOTED TO EACH, PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY—Concluded.

PRACTICAL SCHOOLS OF INDUSTRY: GIRLS.

Studies.	Number of hours per week.		
	First year.	Second year.	Third year.
INDUSTRIAL INSTRUCTION.			
Shopwork	24	27	30
Drawing	6	3	3
Total	30	30	33
GENERAL INSTRUCTION.			
French language	3	3	1½
History	1½	1½	.....
Geography	1½	1½	.....
Natural history and hygiene	.....	1½	1½
Domestic economy	.....	.....	1½
Physics	1½	1½	.....
Chemistry	.....	.....	1½
Arithmetic	1½	1½	.....
Geometry	.....	1½	1½
Accounts	.....	.....	1½
Morals	.....	1	.....
Writing	1	.....	.....
Plain sewing and cutting	3	1½	1½
Total	13	14½	10½
Total hours of instruction	43	44½	43½
Hours of study	6	6	6

PRACTICAL SCHOOLS OF COMMERCE: GIRLS.

Studies.	Number of hours per week.		
	First year.	Second year.	Third year.
COMMERCIAL INSTRUCTION.			
Commerce, accounts, and bookkeeping	4½	4½	4½
Foreign languages	4½	4½	4½
Arithmetic and algebra	3	3	3
Geography	1½	3	3
Writing, etc	3	1½	1½
Chemistry and study of commodities	.....	1½	1½
Legislation	.....	.....	3
Commercial economy	.....	.....	1½
Total	16½	18	22½
GENERAL INSTRUCTION.			
Morals	.....	1½	1½
French language	4½	3	3
Drawing	1½	1½	1½
History	1½	1½	1½
Natural history and hygiene	.....	1½	.....
Geometry	.....	1½	1½
Elements of physics	1½	.....	.....
Domestic economy	.....	.....	1½
Plain sewing and cutting	3	3	3
Total	12	13½	13½
Total hours of instruction	28½	31½	36
Hours of study	4½	4½	3

It has become apparent that to develop manual dexterity, at least twenty-five to thirty hours per week must be passed in the shop. The programme, however, as will be seen in the descriptions of schools, has been modified to suit the requirements of particular localities.

Such modification was expected and was intended; nevertheless, this group probably presents a greater uniformity of organization than any other for what has been termed the primary grade of industrial education.

The following table presents for the year 1900 the principal statistical features in relation to 30 practical schools of commerce and industry:

SUBSIDIES RECEIVED BY PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY, AND NUMBER OF TEACHERS, PUPILS, AND GRADUATES, 1900.

Schools.	Subsidies received from—					Teachers.	
	The State.	The department.	The commune.	Other sources.	Total.	Industrial section.	Commercial section.
Commerce and industry:							
Agen	$4,594	$193	$2,084	$19	$6,890	4	4
Béziers	4,803	.....	4,721	96	9,620	10	5
Cette	1,177	.....	1,872	.....	3,049	.....	4
Fourmies	4,256	.....	1,365	965	6,586	71	52
Grenoble	11,487	1,930	9,637	695	23,749	18	12
Limoges	5,462	67	5,136	.....	10,665	8	6
Le Mans	4,370	347	5,173	116	10,006	10	4
Mazamet	3,648	.....	973	231	4,912	9	5
Nimes	7,076	965	7,920	.....	15,961	12	9
Reims	7,363	289	12,090	.....	19,742	10	6
Romans	3,188	174	2,046	96	5,504	10	.....
Boulogne-sur-Mer	1,467	.....	2,468	.....	3,935	8	.....
Havre	4,695	193	5,723	965	11,576	11	5
Saint-Étienne	4,603	.....	5,018	392	10,013	11	5
Marseille	.....	1,351	9,457	.....	10,808	23	.....
Nantes	4,058	.....	4,613	.....	8,671	13	7
Rouen	1,004	.....	4,367	.....	5,371	8	2
Industry:							
Brest	2,007	97	2,648	.....	4,752	9	.....
Boulogne-sur-Mer	2,530	109	2,953	39	5,631	7	.....
Havre	4,169	39	8,337	.....	12,545	11	.....
Lisle	.....	.....	5,887	.....	5,887	10	.....
Montbéliard	4,998	.....	1,414	.....	6,412	11	.....
Morez	2,567	482	562	154	3,765	7	.....
Rennes	2,108	.....	3,175	.....	5,283	8	.....
Rouen	2,905	.....	5,927	.....	8,832	13	.....
Saint-Chamond	3,117	.....	2,928	.....	6,045	10	.....
Saint-Didier-la-Séauve	2,654	193	477	.....	3,324	5	.....
Saint-Etienne	9,564	.....	11,708	259	21,531	19	.....
Commerce:							
Boulogne-sur-Mer	3,030	.....	1,536	97	4,663	.....	5
Narbonne	3,122	.....	2,248	.....	5,370	.....	3
Total	116,022	6,429	134,463	4,184	261,098	346	134

Schools.	Pupils on October 1, 1900.					Graduates.	
	Boys.		Girls.		Total.		
	Industrial section.	Commercial section.	Industrial section.	Commercial section.		Industrial section.	Commercial section.
Commerce and industry:							
Agen	66	64	.....	.....	130	8	6
Béziers	74	68	.....	.....	142	10	7
Cette	32	29	.....	.....	61	.....	.....
Fourmies	148	66	.....	.....	214	6	4
Grenoble	148	187	.....	.....	335	6	13
Limoges	106	103	.....	.....	209	10	10
Le Mans	118	33	.....	.....	151	8	5
Mazamet	83	91	.....	.....	174	.....	.....
Nimes	131	139	.....	.....	270	13	8
Reims	142	33	.....	.....	175	24	6
Romans	74	.....	.....	.....	74	6	.....
Boulogne-sur-Mer	.....	.....	118	.....	118	.....	.....
Havre	.....	.....	158	93	251	11	13
Saint-Etienne	.....	.....	137	69	206	10	9
Marseille	.....	.....	304	.....	304	.....	.....
Nantes	.....	.....	102	111	213	6	6
Rouen	.....	.....	104	13	117	11	3

SUBSIDIES RECEIVED BY PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY, AND NUMBER OF TEACHERS, PUPILS, AND GRADUATES, 1900—Concluded.

Schools.	Pupils on October 1, 1900.					Graduates.	
	Boys.		Girls.		Total.	Industrial section.	Commercial section.
	Industrial section.	Commercial section.	Industrial section.	Commercial section.			
Industry:							
Brest	114				114	16	
Boulogne-sur-Mer	110				110	24	
Havre	252				252	13	
Lille	50				50		
Montbéliard	118				118	15	
Morez	44				44		
Rennes	60				60	12	
Rouen	177				177	27	
Saint-Chamond	87				87	7	
Saint-Didier-la-Séauve	36				36	4	
Saint-Etienne	345				345	33	
Commerce:							
Boulogne-sur-Mer		97			97		10
Narbonne		31			31		
Total	2,515	941	923	286	4,665	280	100

NATIONAL TRADE SCHOOLS.

The four national trade schools at Armentières, Nantes, Vierzon, and Voiron occupy a peculiar position in the system of State institutions for industrial education, and must be placed in a class by themselves. These schools, in a measure, did not serve the purpose for which they were intended. When the Government attempted, by virtue of the law of December 11, 1880, to establish an organized system of primary industrial instruction it decided to establish a school which was to serve as a model for the departmental, communal, and other institutions contemplated in the law. The school at Vierzon was therefore opened in 1881. It was followed by those at Armentières and Voiron in 1882. These schools did not begin active operations, however, until several years after those dates. That at Voiron was formally opened in 1886, while those at Armentières and Vierzon were not opened until 1887.

The difficulties which arose in respect to the application of the law of 1880, and its failure to cause the founding of special apprenticeship schools, have been fully considered heretofore. It has also been shown that, even after having been modified by the decree of March 17, 1888, the principal effect of the law was merely to cause the extension of the programmes in a number of superior primary schools in order that they might give attention to industrial education. Very few new manual apprenticeship schools were ever formed under the law.

During the period of inactivity after the passage of the law of 1880 a sentiment developed in favor of a type of school in which the industrial should predominate over the general instruction. This sentiment led to the creation of the practical schools of commerce and industry,

which are much more practical in character than the institutions originally contemplated in the law. The latter schools have consequently occupied the field which the "manual apprenticeship" schools were intended to cover, and the national trade schools have not been imitated.

In 1898 a fourth school was created at Nantes by the transformation of a private institution into a national trade school.

These four schools remained, according to the provisions of the law of 1880 (as subsequently modified), under the joint control of the ministry of public instruction and the ministry of commerce and industry until the year 1900, when they were placed under the exclusive control of the latter ministry.

The schools at Armentières, Vierzon, and Voiron have the same general organization. Each has three departments—a kindergarten (*école maternelle*), an elementary primary school, and a superior primary school. The trade education proper is not begun until the pupil has entered the superior primary school. The departments are practically independent schools. The school at Nantes differs from the general plan in that the first two departments are absent.

The technical instruction in the four schools relates chiefly to the wood and metal-working trades. The programme of each school, however, includes special courses relating to industries most developed in the region in which the school is located. Thus special attention is given to weaving at Armentières and Voiron, and to the making of agricultural tools at Vierzon. An agricultural department has been added at Vierzon and Voiron. The students may be boarders, half boarders, or day scholars. The price for the full boarders is 500 francs ($96.50) a year. Scholarships are given by the State, and by departments, communes, and private persons.

TRADE SCHOOLS FOR SEVERAL TRADES.

A certain number of schools, some of which present characteristics similar to those of the practical schools, are placed in this class. They are genuine trade schools that have been established by the National Government, by municipalities or departments, private bodies, religious organizations, etc., for giving instruction in several trades. Some of them were the result of the law of December 11, 1880, in regard to manual apprenticeship schools. Others, however, were in existence before that law went into effect. The latter are mostly private institutions, but one or two municipal schools had also been established before that date.

Only those schools in which instruction is given during the day, and in which both theory and practice are combined, have been placed in this class. Institutions for both sexes are included and the tech-

nical instruction given in them is that known as the primary grade. Their chief object is to fit students to enter the trades or industrial occupations as workmen with at least a fair theoretical and practical knowledge of them. Some even aim to take the place of a complete apprenticeship and a few are apprenticeship shops or schools in which the theoretical instruction is reduced to the minimum.

The relative proportion of time allotted to theoretical and practical instruction in this class of schools varies. It depends upon the importance attached to each branch of instruction by the founders of the individual schools. In some institutions the theoretical part is reduced to the minimum, while in others it occupies a large part of the time, and includes a rather complete course of general instruction. Institutions in which the general and theoretical instruction have been given the principal share of time and the practical work limited to a few hours each week have been excluded from the class. Some of the latter institutions have been placed in a distinct class under the term "general industrial schools."

Other schools, in which the shopwork occupies but a very few hours per week, have been omitted from all classes. Such schools are generally those which prepare students for higher technical institutions that demand a certain amount of shop training as a condition of entrance. Hence, they devote no more time to shopwork than is sufficient to demonstrate the students' aptitudes and to meet the requirement mentioned. The shopwork is merely manual training. Religious organizations have established a number of this latter class of schools under the name of preparatory schools. They devote but four or five to seven or eight hours a week to shopwork and can not be considered trade schools, although the general and theoretical instruction often has a direct bearing toward industrial work. A few of these congregational schools, which fulfill certain requirements, have been placed in the class of "general industrial schools."

Students enter the trade schools at about the age of 13 and remain in them for three or four years.

A complete list of the institutions that fill all the requirements of this classification can not be presented. Those which have the most complete organization of studies and practical work and the most definite aims with reference to the preparation of students for entering trades or industrial work are as follows, the group schools for males being first enumerated:

Public schools: National Apprenticeship School, Dellys, Algeria; Alembert Departmental School of Typography and Woodworking, Montévrain; Municipal School of Weaving and Embroidery, Lyon; Boulle Municipal School of Furniture Making, Paris; Municipal School of Physics and Industrial Chemistry, Paris; Estienne Municipal School

of Printing and Publishing, Paris; Diderot School of Wood and Metal Working, Paris; Dorian Municipal School of Wood and Metal Working, Paris.

Private schools: School of Apprenticeship for the Wood and Metal Working Trades, maintained by the Amiens Industrial Society, Amiens; School of Apprenticeship for the Metal Working Trades, maintained by the firm of Simon Frères, Cherbourg; School for Machinists' Apprentices in the Merchant Marine, Havre; Trade School of the Eastern Railroad Company, Mohon; Institute for Deaf Mutes, Saint-Etienne; Wood and Metal Working School, maintained by the St. Quentin Industrial Society, Saint-Quentin.

Congregational schools: Lewarde School, Douai; St. Gabriel Orphanage, Lisle; apprentice shops founded by the Abbé Boisard, Lyon; St. Léon School, Marseille; St. Peter School, Nice; School of Jesus Adolescent, Oran, Algeria; St. Nicholas School, Paris; Sts. Peter and Paul School, Paris; Œuvre d'Auteuil (apprenticeship shops for abandoned boys), Paris; St. Michel Primary and Trade School, Priziac; trade school at the Orphanage of the Immaculate Conception, Toulouse.

The trades taught in the municipal and private schools have been partially indicated in the titles of the schools as given above. In the Catholic schools the greatest variety of trades are taught. Aside from the ordinary wood and metal working trades, some schools teach the various printing trades, fine mechanical work, shoemaking, tailoring, certain of the building trades, wood carving, etc. As this class, next to that of the practical schools, forms the most important means of providing trade instruction designed to take the place of apprenticeship, several representative institutions will be fully described under individual schools.

Group schools for females are also included in this class. They have been established by both public and private effort. Seven schools for females are public in character. Of these, 6 were founded by the municipality of Paris and 1 by the departmental and communal authorities at Yzeure. Eight schools are the result of private initiative—3 at Paris, 1 at Levallois-Perret, 1 at Loges, 1 at Chaumont, 1 at Nancy, and 1 at Lyon.

There is no need to name the very large number of institutions for girls conducted by various religious organizations. While they are important they are not very well known, being largely, if not altogether, conducted by organizations that maintain a strict seclusion. In the great majority of such institutions the instruction relates only to the ordinary trades adopted by women, as sewing, dressmaking, millinery, etc., or to the ordinary work necessary in the proper care of the household.

TRADE SCHOOLS FOR SINGLE TRADES.

A number of excellent schools for single trades exist in France. As in the case of the preceding group only those schools that hold day sessions, and in which both the theory and practice of the trades are taught, are included in this classification. By far the greater number of them aim to give the student a complete training in the particular trade taught, at least as complete as can be obtained in a school. Much time is spent in shopwork. In some schools shopwork is the principal feature of the instruction, while in others the time is about equally divided between shopwork on the one hand and theoretical and general instruction on the other. A few schools in which the instruction is somewhat higher than that comprehended under the term primary are included in this class. This is made necessary to avoid a multiplication of classes, as the instruction in such schools is not sufficiently advanced to warrant placing them in the class of schools for advanced industrial education. Nearly all the schools for single trades are maintained by private bodies, associations, etc.

No attempt is made to present a complete list of those that properly come within this class. From the various reports at hand the following have been selected as fulfilling all the requirements of a genuine trade school:

Public schools: School of Industrial Chemistry (annexed to university), Lyon; National School for Mine Bosses and Foremen, Alais; National School for Mine Bosses and Foremen, Douai; Communal Spinning and Weaving School, Flers; National School of Watchmaking, Besançon; National School of Watchmaking, Cluses; Municipal Weaving School, Sedan.

Private schools: Apprenticeship School of the Association of Carriage Workers, Paris; School of Electricity (*Institut Ampère*), Saint-Germain; Apprenticeship School of Furniture Making and Joinery, Cherbourg; French School of Hosiery, Troyes; Lace-Making School for Girls, Bailleul; Lace-Making School for Girls, Cherbourg; Trade School for Shoemakers, Paris; School of the Apprentice Tailors Patronal Committee, Paris; Textile School (*École Manufacturière*), Elbeuf; Industrial School of Textiles, Tourcoing; Guttenberg Typographical School, Paris; Practical School of Watchmaking, Anet; Trade School of Watchmaking, Paris.

A number of these institutions are described in detail under individual schools.

GENERAL INDUSTRIAL SCHOOLS.

This class has been added for the purpose of distinguishing a certain number of schools that, regardless of designation, can not properly be placed among the trade schools as above defined. It includes those schools that have regular day sessions and a well-organized programme of study comprising both theoretical and practical (manual) work, but

in which the former either occupies a predominant place or the latter shows very little or no tendency toward specialization in a given trade.

Several of these institutions take the name of "trade school," but, with the explanation given above, it is safe to place them in this class. A few belong to the public advanced primary grade of schools which devote a larger portion of time than usual to industrial instruction. In some of them the work is in a measure preparatory to the higher industrial schools of the State, but where that is made the chief or only aim the school has been omitted from the list below.

The object of the instruction given in these institutions is not specialization in particular trades, but to give an all-round industrial education in which scientific theory occupies an important place. The grade of the instruction, however, shows considerable variation when individual schools are compared. This depends, of course, upon the object sought, whether it be to form pupils for the higher or less important industrial careers.

Following is a list of the schools that have been placed in this class:

Public schools, maintained by departments or communes: Superior Trade School, annexed to the Normal School, Angoulême; Industrial School of the Vosges, Épinal; Martin School for Boys, Lyon; Manual Apprenticeship School, Monthermé; Departmental School for Deaf-mutes and the Blind, Nantes; Industrial Section annexed to the college, Saint Nazaire; Industrial Section of the Rouvière Advanced Primary School, Toulon; Industrial Section of the School of Fine Arts and of Industrial Sciences, Toulouse.

Private schools: Hanley Trade School, Choisy-le-Roi (Seine); Durzy Trade School, Montargis; Eastern Trade School, Nancy; Trade School of the Northern Railway Company, Paris; Special School of Public Works, Paris; Bertrand Industrial, Trade, and Commercial School, Versailles.

In addition to these, there is a number of schools conducted by Catholic organizations in which the instruction is to a certain extent industrial and which do not necessarily belong to the class of preparatory schools with shops for manual training previously mentioned. The most important of these are: La Salle School, Lyon; J. B. de la Salle School, Reims; Mixed Trade and Preparatory School, Rive de Gier; St. Joseph Boarding School, Saint Omer; School of Mines, Commentry; St. Joseph School, Landerneau.

A few of the industrial schools are described in detail under individual schools.

TRADE AND TECHNICAL CONTINUATION SCHOOLS AND COURSES.

Under this comprehensive head are placed a very large number of institutions that owe their existence to various forms of initiative, both public and private. With but two or three exceptions, the instruction

is given in these institutions only in the evening or on Sunday. There are very few that operate on Sunday, however, so it may be said that nearly all of them are evening schools or courses. The exceptions to this general rule will be mentioned later.

These are essentially institutions for the instruction of workmen and apprentices. They are intended to supplement the shop training with technical (theoretical) instruction, or theoretical instruction plus a certain amount of practical application directed toward specific trades or lines of industrial work.

This class of institutions constitutes practically the only means of reaching those actually engaged in industry, and for that reason and because of the great number and wide distribution of the schools and courses it contains it is really a most important one. The institutions herein contained present every variety of organization and arrangement of programme.

Two general types of institutions are to be found in the class—one in which practical work finds a place in the course of study, and one in which the manual work is absent, the instruction being purely of a technical (theoretical) nature. It is not considered advisable to treat each type separately, although in the list presented below the institutions have been separated on the foregoing basis.

These institutions have been established and are maintained by the minor public authorities, by trade unions, employers' associations, labor exchanges (*bourses du travail*), workingmen's clubs, friendly societies of workingmen in particular industries (*unions compagnonniques*), individuals, etc. The great and increasing interest shown by the workmen themselves in the propagation of this species of education is worthy of note.

Two or three day schools which are intended to give a theoretical and practical course in some particular trade to persons already engaged in the trade, but in which instruction is given only a few months or a year at most, have been placed in this class. Such institutions can not be called trade schools, as they are intended merely to further extend the knowledge gained by experience.

No extended consideration of these institutions is necessary, but a few of their principal characteristics will be mentioned. As a general rule they are open for from three to six evenings a week. The total time per week devoted to any given trade ranges from 2 to 6 or more hours and in some cases up to 10 or 12 hours a week. The technical studies included in their curriculi naturally depend upon the nature of the trades to which the instruction relates, but drawing is always one of the essentials. Tuition in these schools and courses is free as a rule, although in exceptional cases a small fee is charged.

Practical work, when present, is frequently done on a reduced scale,

although in some schools, as in those for weaving, for instance, shops are fitted up with looms and material for giving regular practical courses the same as in day schools. This is true in a few cases in schools for the wood and metal working trades. When the opportunities for practical work under natural conditions are lacking, various expedients are in many cases adopted. For instance, in the case of a continuation school for roofers, a sort of rack is arranged on which the tiles are placed, and afterwards removed. In several joinery continuation schools articles are made on a reduced scale, while in one or two schools or courses for stonecutters blocks of imitation stone (or plaster) are used. Other examples need not be mentioned. Wherever possible, however, practical work in those schools that require it is done under conditions approaching those to be met in actual industry. In a few cases a little productive work is done which is disposed of in the market.

The duration of studies in a given trade is from one to four years. The length of the school term is variable and depends much upon the nature of the trade taught.

Many of these institutions receive subsidies from the State, department, or commune. When they receive State subsidies they are placed under the State inspection system as previously stated. These schools and courses are as a rule well attended by apprentices and young workmen. Several institutions in this class are intended for girls. In a few institutions the instruction relates to a single trade, but in the majority of them it relates to two or more trades. The latter correspond to the group schools of the class giving instruction through the day.

An idea of the large number of trades to which the instruction in this class of institutions relates may be gained from a perusal of the following enumeration of schools and courses. The first part of the list contains those schools and courses in which practical work forms part of the course of study:

PUBLIC SCHOOLS AND COURSES MAINTAINED BY MUNICIPALITIES OR COMMUNES.

Courses in wood and metal-working and other trades, annexed to the municipal school of drawing, Laval.

Courses in spinning and weaving, under the patronage of the Industrial Society of the North, Lisle.

School of brewing (three months' day course for workmen, foremen, etc.), annexed to the University, Nancy.

School of hand weaving, called "*École de fabrique*," Nîmes.

School of industrial chemistry and dyeing, Saint-Etienne.

School for joinery, carpentry, stonecutting, and mechanics, Troyes.

Courses in theory and practice of weaving, Vienne.

PRIVATE SCHOOLS AND COURSES MAINTAINED BY TRADE UNIONS, EMPLOYERS' ASSOCIATIONS, TRADE AND OTHER SOCIETIES, LABOR EXCHANGES, INDIVIDUALS, ETC. [a]

Courses in weaving, dyeing, etc., maintained by the Industrial Society, Amiens.

Courses in the metal-working trades, joinery, stonecutting, and painting, Angoulême.

Courses in industrial drawing, painting, carpentry, roofing, and stonecutting, Blois.

Courses in tailoring, tin and zinc working, typography, and paper hanging, Bordeaux.

School for barbers and hairdressers, Bordeaux.

School of stereotomy, Bordeaux.

Courses in upholstering (cutting), wood carving, and cabinetmaking, Bordeaux.

School for the wood and metal working trades, known as "*Émulation Dieppoise,*" Dieppe.

Courses in weaving, fine drawing, etc., maintained by the Industrial Society, Elbeuf.

Courses in carpentry, cabinetmaking, stonecutting, ceramic painting, tailoring, shoemaking (cutting), hairdressing, etc., maintained by the Labor Exchange, Elbeuf.

Courses in wool spinning and weaving, etc., Fourmies.

Courses in wood and metal working, Fumel.

Courses in plastering, painting, tailoring, and stonecutting, Lyon.

Courses in modeling, molding, etc., in relation to stone carving (sculpture), Lyon.

Courses in tailoring (cutting), Lyon.

Jean-de-Tournes school for printers, lithographers, bookbinders, and gilders, Lyon.

Trade school for hairdressers, Lyon.

Courses in shoemaking, Montpellier.

School for barbers and hairdressers, Montpellier.

Courses in the principal building and other trades, Nantes.

School for hairdressing, Nantes.

Courses in painting, shoemaking, carpentry, joinery, housesmithing, zinc working, roofing, and saddle and harness making, Nantes.

Courses in stereotomy, carpentry, joinery, etc., Nevers.

Trade school of baking, Paris.

Parisian school for barbers and hairdressers, Paris.

Improvement courses for journeymen bookbinders and gilders, Paris.

Trade school for journeymen carpenters, Paris.

Schools of carpentry (2 schools) maintained by Employers' Association, Paris.

Courses for carriage workers (body makers and carriage builders), maintained by the Wagon Makers' Union of the Seine, Paris.

Courses for carriage workers (wood and iron work), maintained by Carriage Workers' Union, Paris.

Courses for carriage workers, maintained by the Society of Journeymen Cartwrights, Paris.

Central school of industrial designing in relation to metal chasing, engraving, jewelry working, etc., Paris.

School of drawing, modeling, and bronze chasing, Paris.

Trade courses for chimney builders and repairers, etc., Paris.

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[a] The particular form of direction under which private schools or courses (or groups of courses) operate has not usually been mentioned except where necessary to distinguish between two or more similar institutions in the same city.

Trade courses of the Union of Journeymen Housesmiths, Paris.

Trade school for drawing and modeling of the Union of Jewelers, Goldsmiths, etc., Paris.

Trade school of design for imitation jewelry manufacture and allied industries, Paris.

Trade school for joiners, Paris.

Trade school of the Paper and Paper Goods Makers' Union, Paris.

Courses in pattern designing, etc., for bar-loom passementerie work, Paris.

Trade school of the Union of Bar-Loom Passementerie Weavers, Paris.

Courses in roofing, plumbing, gas fitting, etc., maintained by the Association of Master Roofers and Plumbers, Paris.

Courses in typography (presswork and branches relating to composition), Paris.

Courses for upholsterers, decorators, etc., Paris.

Courses in various building trades, Périgueux.

Courses in relation to textile manufactures, chemistry, physics, steam firing and engineering, maintained by industrial society, Reims.

Practical courses in carpentry and stair building, Romanèche-Thorins.

Courses (evening) for firemen, given under private direction at the Practical School, Saint-Etienne.

School for mine bosses (one year's day course), Saint-Etienne.

School for apprentice masons and stonecutters, Samoens.

Courses in shoemaking, tailoring, joinery, carpentry, plumbing, etc., Toulouse.

Courses in stonecutting, various wood and metal working trades, shoemaking, plastering, hat making, coach making, etc., Villeneuve-sur-Lot.

The continuation schools and courses in which the instruction is purely theoretical are the following:

PUBLIC SCHOOLS AND COURSES MAINTAINED BY MUNICIPALITIES OR COMMUNES.

School of stereotomy and drawing for stonecutters, Château-Landon.

Courses in applied sciences (industrial) for adults, Dieppe.

Technical course in cloth manufacture, Lavelanet.

Advanced courses (evening) for adults, given at the Practical School, Nîmes.

PRIVATE SCHOOLS AND COURSES MAINTAINED BY EMPLOYERS' ASSOCIATIONS, TRADE UNIONS, LABOR EXCHANGES, INDUSTRIAL SOCIETIES, INDIVIDUALS, ETC.

Courses of technical instruction in relation to various trades, Brest.

Courses in joinery, shoemaking, stonecutting, and cooperage, Cognac.

Course in drawing and modeling in relation to masonry, Grenoble.

Technical courses in steam engineering, Marseille.

Technical (including trade) courses maintained by various trades under the general supervision of the labor exchange (*bourse du travail*), Marseille. The principal trades are those of carriage makers, firemen and engineers, hairdressers, cooks, shoemakers, tailors, machinists, blacksmiths, marble-cutters, house painters, locksmiths and artistic iron workers, stonecutters, and carpenters and joiners.

Apprenticeship school (various trades) maintained by the Industrial Society, Nantes.

Course for firemen and engineers (members of organization), Nantes.

Courses in tailoring, joinery, stonecutting, and shoemaking, Nîmes.

Technical courses (school) for apprentices in the wood and metal working, etc., trades, Oran, Algeria.

School of cabinetmaking, maintained by the Association for the Protection of Apprentices, Paris.

Technical courses in relation to the carriage-making trades, Paris.

Technical courses maintained by the Central Union of Firemen, Engineers, etc., for members of the corporation, Paris.

Courses maintained by the Central Federation of Firemen, Engineers, and Automobile Drivers, for members, Paris and suburbs.

The correspondence school of flour milling, Paris.

Trade school of horseshoeing, Paris.

School for apprentices and journeymen in the house-furnishing trades, maintained by trade unions, Paris.

Courses in relation to joinery (4 schools), maintained by the Master Carpenters' Association, Paris.

Technical courses in relation to joinery, Paris.

The modern school of joinery of M. Jeannin, Paris.

Technical courses in relation to locksmithing (2 schools), maintained by the Master Locksmiths, etc., Association, Paris.

Technical courses maintained by the General Federation of Locomotive and Stationary Engineers and Firemen, Paris and other places.

Technical courses for machinists, Paris.

Technical courses relating to masonry, maintained by Employers' Association, Paris.

Technical courses for masons and stonecutters, maintained by a private club, Paris.

Technical courses in stonecutting (3 schools or courses), maintained by the Stone-Cutters' Union, Paris.

Technical courses in cutting, maintained by Union of Master Tailors, Paris.

Courses in relation to various building trades, metal working, weaving, tailoring, carriage making, dressmaking, etc., Saint-Etienne.

Technical courses in various trades, maintained by the labor exchange (*bourse du travail*), Toulouse.

Technical courses for stone masons, cutters, and sawyers, Versailles.

A number of representative institutions of this class are described under individual schools.

In connection with these institutions particular mention should be made of a very important influence that is actively engaged in extending and popularizing industrial education in France. Reference is had to certain organizations existing under the names philotechnic, polytechnic, and philomathic associations, societies for popular education, etc. These are rather numerous in France, nearly every important city either having its own association or a branch of one of the larger ones. Most of the earlier associations were formed for the purpose of extending popular education. When the movement for industrial education became active, many societies added trade and technical courses to their programmes, and in recent years this has become the most prominent feature of the work of many organizations. The industrial instruction given under their auspices usually takes the form of free courses which are either entirely theoretical in character or theoretical with the addition of manual work, according to the nature of the trade taught, or the views of the founding society. The courses of instruction properly belong to the lists presented above, but have not been included there for various reasons. In addition to

maintaining courses for trade and technical education some of these societies provide courses for commercial instruction (including commercial law, geography, languages, bookkeeping, typewriting, and stenography), courses relating to agriculture, to horticulture, art, etc. Many societies maintain courses in weaving, cutting and dressmaking, artificial-flower making, millinery, etc., for women and girls. The work of some societies does not end with the provision of facilities for trade, commercial, and art education. It often includes free lecture courses on subjects of interest, as hygiene, medicine, natural sciences, courses of general instruction for those who have been deprived of the opportunity to attend school for a sufficiently long period, etc.

Following are some of the most important societies and other organizations engaged in providing facilities for industrial education: The Philotechnic Association, the Polytechnic Association, and the Society for Trade and Technical Instruction Relating to Marine Fishing, Paris; the Polytechnic Association, Levallois-Perret; the Philomathic Association, Bordeaux; the Rhône Society for Trade Education, Lyon; the Polytechnic Association, Marseille; the Industrial Society, Saint-Quentin and Aisne; the Dyonisian Group, Saint-Denis, and others which need not be enumerated.

Several societies receive subsidies from the State, departments, municipalities, etc.

While the instruction given under the auspices of these societies more frequently partakes of the nature of continuation courses, in a few instances regular day schools have been instituted. The Industrial Society of Saint-Quentin, for instance, maintains a regular group school of wood and metal working in addition to courses of from one to two years' duration in theoretical and practical weaving, mechanical weaving, mechanical embroidery, lingerie making, decorative drawing, card designing (or making) for curtains, etc., and designing and card making for embroideries. The number of hours per week devoted to these courses ranges from 18 to 60. These courses and the school are all sheltered in the same building and constitute an unusual form of institution for industrial education in France. The institution is really a large group school and has been so listed. The work of a number of individual societies is described in detail in another part of this report.

INDUSTRIAL DRAWING SCHOOLS.

As previously stated, although the municipalities as a rule have not been active in establishing trade schools, they have devoted considerable attention to drawing applicable to various kinds of industrial work. Many of them have founded schools in which the main object is to teach drawing applicable to certain specific occupations. In other instances courses in industrial drawing have been annexed to

other institutions—to art schools, etc. A few schools of industrial drawing owe their existence to private effort.

The programmes followed depend upon the local industries which these schools are intended to benefit. In many cases the school operates only during the evening. Schools in which industrial drawing is the chief aim or in which workmen may take courses in drawing in relation to their trades are maintained by minor public bodies at Angers (in connection with Regional School of Fine Arts), Annonay, Aubenas, Bar-le-Duc, Belfort, Cambrai, Charleville, Épinal, Gérardmer, Grenoble (a school of drawing and decorative cement molding, etc.), Havre, Langres, La Rochelle, Lyon, Nevers (at School of Arts), Nogent-sur-Seine, Poitiers (at Regional School of Fine Arts), Rambervillers, Rochefort, Saint-Chamond, Saint-Dié, Sedan, Troyes, and other places outside Paris. In Paris there are several schools in which industrial drawing constitutes an important part of the programmes. The best known institution for boys is the Germain-Pilon School, which is owned by the municipality. In addition several private drawing schools for girls in which industrial drawing forms an important part of the programme, are subsidized by that city.

There are also several private schools of this class. The most important are at Privas, Nantes (drawing courses in relation to joinery and cabinetmaking), and Paris (drawing course in relation to carpentry work). A few of this class are described under individual schools.

In the general account of French schools institutions for girls have not been separately considered. This has not been thought necessary, because of their relative unimportance and for the reason that there is nothing particularly characteristic in relation to them.

They have been mentioned occasionally in connection with the consideration of the classes of schools for males to which they correspond. Those classes are the practical schools of commerce and industry, the two classes of trade schools proper, the continuation schools and courses, and the industrial drawing schools. Schools for girls maintained by Roman Catholic organizations have received no consideration, for reasons already stated. There are a few—perhaps six or eight—courses or schools for women and girls that do not enter into any of the general classes heretofore enumerated. These are institutions that have as their principal aim instruction in relation to the proper performance of household duties. They are similar to the housekeeping schools and classes of Belgium, which are fully described in the introductory pages of the chapter on trade and technical education in that country.

There are no general statistics available for any other than the practical schools of commerce and industry and the State schools under the ministry of commerce. The statistics in relation to the former

have already been shown. Those for the State schools under the ministry of commerce are summarized in the following table:

RECEIPTS AND EXPENDITURES OF NATIONAL TRADE AND INDUSTRIAL SCHOOLS AND NUMBER OF TEACHERS, PUPILS, AND GRADUATES FOR THE YEAR 1900.

RECEIPTS.

School.	Subsidies.	Board and tuition.	Proceeds from sale of products.[a]	Total.
National Conservatory of Arts and Trades, Paris	$93,890	.....	.....	$93,890
Central School of Arts and Manufactures, Paris	.....	$143,665	.....	143,665
National School of Arts and Trades, Aix	79,663	17,471	$757	97,891
National School of Arts and Trades, Angers	82,232	14,181	2,033	98,446
National School of Arts and Trades, Châlons-sur-Marne	82,808	18,455	2,041	103,304
National School of Arts and Trades, Lisle	6,119	.....	.....	6,119
National Practical School for Workmen and Foremen, Cluny	64,539	7,237	340	72,116
National Watchmaking School, Cluses	10,289	.....	487	10,776
National Watchmaking School, Besançon	4,522	.....	2,585	7,107
National Trade School, Armentières	15,980	17,523	103	33,606
National Trade School, Nantes	22,541	14,187	.....	36,728
National Trade School, Vierzon	39,307	22,842	822	62,971
National Trade School, Voiron	15,556	16,796	181	32,533
Total	517,446	272,357	9,349	799,152

EXPENDITURES.

School.	Salaries of teachers, etc.	Cost of supplies.	Total.
National Conservatory of Arts and Trades, Paris	$58,991	$34,740	$93,731
Central School of Arts and Manufactures, Paris	112,247	31,254	143,501
National School of Arts and Trades, Aix	37,307	42,356	79,663
National School of Arts and Trades, Angers	37,205	45,028	82,233
National School of Arts and Trades, Châlons-sur-Marne	38,207	44,601	82,808
National School of Arts and Trades, Lisle	1,156	4,963	6,119
National Practical School for Workmen and Foremen, Cluny	24,704	39,825	64,529
National Watchmaking School, Cluses	6,855	3,434	10,289
National Watchmaking School, Besançon	5,080	2,027	7,107
National Trade School, Armentières	14,265	20,071	34,336
National Trade School, Nantes	17,064	7,579	24,643
National Trade School, Vierzon	14,653	23,199	37,852
National Trade School, Voiron	15,475	19,268	34,743
Total	383,209	318,345	701,554

TEACHERS, PUPILS, AND GRADUATES.

School.	Number of—		
	Teachers.	Pupils.	Graduates.
National Conservatory of Arts and Trades, Paris	18	(b)	(b)
Central School of Arts and Manufactures, Paris	c 28	696	210
National School of Arts and Trades, Aix	23	305	154
National School of Arts and Trades, Angers	22	281	93
National School of Arts and Trades, Châlons-sur-Marne	21	266	78
National School of Arts and Trades, Lisle	(b)	(b)	(b)
National Practical School for Workmen and Foremen, Cluny	7	272	75
National Watchmaking School, Cluses	13	141	46
National Watchmaking School, Besançon	10	70	1
National Trade School, Armentières	29	235	25
National Trade School, Nantes	34	340	(b)
National Trade School, Vierzon	8	291	22
National Trade School Voiron	27	249	24
Total	d 240	e 3,146	f 728

[a] The proceeds from sale of products in the national schools are, with the exception of those of the school at Besançon, turned into the public treasury.
[b] Not reported.
[c] Not including 38 instructors of shopwork.
[d] Not including 38 instructors of shopwork and teachers of 1 school not reported.
[e] Not including pupils of 2 schools not reported.
[f] Not including graduates of 3 schools not reported.

INDIVIDUAL SCHOOLS.

A general description of the French system of trade and industrial education has been presented in the foregoing pages of this chapter. In the following pages a certain number of schools in each class have been selected and described as fully as their importance would justify. In addition to data collected by the department there was available the exhaustive report, (a) in five volumes, made by the minister of commerce and industry for the Paris Exposition of 1900. This report relates to schools under the jurisdiction of the ministry of commerce and industry. The municipal trade schools of Paris are fully described in a report (b) published in 1900. The Catholic schools are described in a volume (c) published by Émile Cail for the Exposition during the same year (1900).

SCHOOLS FOR ADVANCED INDUSTRIAL EDUCATION.

A few important schools belonging to this class are described in the following pages. Brief statements in reference to other schools of the class have already been made.

NATIONAL SCHOOL OF ARTS AND TRADES, CHÂLONS-SUR-MARNE.

In 1788 the Duke de la Rochefoucauld-Liancourt conceived the idea of creating special establishments in which children could receive general instruction and at the same time serve an apprenticeship in certain trades. With this end in view he founded a school of such character at his own expense on his farm near Liancourt (Oise). At first only the sons of noncommissioned officers of his regiment were admitted to this school.

In 1799 the Government of the first republic, struck by the merits of the institution, made it a national school and transferred it to Compiègne under the name of the French Prytaneum. Bonaparte took a great interest in the school. During the course of a tour of the industrial cities of the north he visited the school at Compiègne. He had previously been impressed with the necessity for trade training, for he said, "I have everywhere found foremen distinguished in their trade and possessing great skill in execution, but almost no one

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a L'Enseignement technique en France. Étude publiée à l'occasion de l'Exposition de 1900. Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes. 5 volumes, 1900.

b Les Écoles et les Oeuvres Municipales d'Enseignement 1871–1900. Par F. Lavergne, Chef du Secrétariat de la Direction de l'Enseignement, Ville de Paris.

c L'Enseignement Industriel et Commercial dans les Institutions libres Catholiques, rapport présenté à l'Exposition universelle internationale de 1900. Émile Cail.

who is able to make a plan or the simplest calculation of a machine or express his ideas in a sketch or statement. This is a great lack in French industry. I wish to provide for it here. There shall be no more Latin that can be learned in lyceums that will be organized but the trades, with the theory necessary to progress, will be taught. Here excellent foremen will be formed for our manufacturing establishments."

On February 25, 1803, Bonaparte, in conformity with the ideas he had expressed, reorganized the school of Compiègne. In 1806 the school, on account of the increasing number of students, was transferred to Châlons-sur-Marne, where it was installed in the buildings of an old convent.

The work of this school has undergone important modifications which it will be of interest to trace. In the beginning children were admitted at the early age of 8 years, and, after receiving a general education, were placed in the classes for technical instruction. The duration of studies was indeterminate and the pupils sometimes remained 10 years in the school. There were at first five principal shops in which instruction was given in different trades, as follows: First shop—The trades of blacksmith, filer, fitter, and metal turner; second shop—the trade of molder; third shop—the trades of carpenter, joiner, and cabinetmaker; fourth shop—the trade of wood turner; fifth shop—the trade of wagon maker.

After the Restoration schools of this class were somewhat neglected, their true aim was lost sight of, and they came to be regarded as institutions for general instruction. In 1827 a reorganization was effected in order to bring them back to their true purpose. Matriculants were required to be 13 years of age. The duration of studies was fixed at 4 years. The time devoted to practical instruction was increased and that given to theory reduced. In 1832 another change was effected. The entrance age was raised to 15 years, and for the first time candidates were required to pass a competitive examination and also show that they had served at least one year's apprenticeship in a trade similar to one of those taught in the school. The duration of the courses was also reduced to 3 years. Other changes were made in 1848, 1865, and 1873.

The year 1885 was one of great significance for the schools of arts and trades, as on April 4 of that year a decree was issued completely reorganizing them, both in regard to the conditions of admission and the programme of studies. Industry had, in the preceding years, passed through important changes and the purpose of the decree was to modify the character of the schools so that they would correspond to the new conditions and needs. The work accomplished by this decree has been supplemented by the decree of October 11, 1899.

The first paragraph of the latter decree states that the purpose of

the schools is to train workmen capable of becoming heads of industrial establishments, and manufacturers skilled in the practice of the mechanical arts. The most important changes introduced through the recent reorganization are the increased importance given to shop-work and a general raising of the standard of instruction. Of the instruction given, the official report on trade education in France says: "That which characterizes this instruction is the manual work, the shop practice, to which not less than 6 hours' time each day is devoted. * * * Thanks to this practice of 3 years' duration, there is not a student who receives a certificate from one of these schools as fitter, molder, founder, or blacksmith who can not boldly enter a shop and after a very short time earn there his day's wage. The best advised of the young men, moreover, do not fail to enter the shops and complete, by living some time the real life of an artisan, the practical knowledge acquired in the shops of the school. The administration encourages this practice with all its power."

This and the other three national schools of arts and trades receive only boarding students. The experiment of admitting day students was made for a time, but the results not being satisfactory, the plan was abandoned. The number of students is limited to 300 (for each school). The tuition fee, including board and lodging, is 600 francs ($116) a year, the cost of uniforms and equipment is 300 francs ($57.90), and a further sum of 75 francs ($14.48) must be deposited to meet other expenses. Scholarships or partial scholarships, both with and without the wardrobe outfit, are granted by the State, the departments, and the communes to those students whose parents are not able to pay their expenses. About 75 per cent of the students are in receipt of such aid.

Admittance is obtained through competitive examination. Candidates must be between the ages of 15 and 17 years. After 1903 every candidate will be required to possess a certificate of practical industrial studies (given by the practical schools of industry) or a certificate of superior primary studies. The maximum age limit will at the same time be raised 9 months. The entrance examination includes the following written tests: A page of writing, a dictation exercise, a French composition, an exercise in mechanical drawing, an exercise in ornamentation with pen, problems in arithmetic, algebra, and geometry, problems in physics and chemistry, and a test which serves to demonstrate the candidate's experience in manual exercises. Candidates who pass this examination with a sufficient grade are entitled to take the oral examination which relates to grammar, history, geography, arithmetic, algebra, and geometry.

The complete course of instruction covers a period of 3 years.

The theoretical instruction, which is always of such a character as to have a direct bearing upon industrial operations, includes the following studies: Algebra, from equations of the second degree to New-

ton's theorum and its applications; plane trigonometry, elements of cosmography, surveying, and leveling; elements of analytical geometry; descriptive geometry; shadows; drawings with dimensions marked, as well as notions of ordinary perspective, of stonecutting and carpentry; theoretical and applied kinematics; pure and applied mechanics; physics; electricity and its principal applications, chemistry and its principal applications, especially with reference to metallurgy; drawing; and especially industrial drawing; technology, studied principally in its application to the construction of machines; the French language; history, from Louis XI to the constitution of 1875; geography of France and her colonies; accounts, principles of industrial, commercial, and customs legislation, and principles of social economy; industrial hygiene; moral and civic education.

Though some instruction in electricity had long been given, a special course in this subject was organized by the decree of October 11, 1899. A new chair of applied electricity was created, new electrical workshops were opened, and electrical apparatus provided out of an appropriation for this purpose of 211,150 francs ($40,752).

The practical instruction is given in four workshops, devoted, respectively, to machine mounting or fitting, blacksmithing and boiler making, carpentry and model making, and foundry work. On entering the school, students are distributed among the different shops according to their aptitude and preference. Those obtaining the highest grades in the examinations have the first choice of shops. About 70 per cent enter the machine shop. The course selected is adhered to throughout the 3 years. At the end of the third year, however, each student is required to pass a certain length of time in the other shops in which the work is related to that which the student has been following.

The duration of manual labor in the shops is about 6 hours a day, divided into two sessions. The character of this practical instruction has changed completely. Formerly the students made only small models. At the present time the work performed by the students, especially toward the end of their courses, consists in the construction of machines and other articles similar to those made in ordinary industrial establishments. The following statement shows the way in which the students are employed during each week day: 5.30 a. m., reveille; 5.50 to 6 a. m., recreation; 6 to 7.30 a. m., study; 7.30 to 7.45 a. m., breakfast; 7.45 to 8 a. m., recreation; 8 to 9.30 a. m., recitation; 9.30 a. m. to 12 m., shopwork; 12 m. to 12.20 p. m., dinner; 12.20 to 1.30 p. m., recreation; 1.30 to 3.15 p. m., drawing; 3.15 to 7 p. m., shopwork; 7 to 7.20 p. m., supper; 7.20 to 7.30 p. m., recreation; 7.30 to 8.45 p. m., study; 8.45 to 9 p. m., recreation; 9 p. m., retirement.

The schools are in all cases excellently housed, and the shops leave nothing to be desired in respect to accommodations and equipment.

NATIONAL PRACTICAL SCHOOL FOR WORKMEN AND FOREMEN, CLUNY.

The National School for Workmen and Foremen, at Cluny, has the distinction of being the only one of its kind in France. It was created by the law of July 21, 1891, for the purpose of supplying in a certain measure the place in the system of trade education left vacant by the gradual raising of the character of instruction in the national schools of arts and trades until they no longer corresponded to the needs of persons expecting to enter the lower ranks of industry.

The minister of commerce explained the situation at some length during the debate on the bill which provided for the establishment of this school. The trend of his remarks was directed in the main toward pointing out the gap that existed between the schools of arts and trades on the one hand and the superior primary and trade and the manual apprenticeship schools on the other, and the necessity for a grade of institutions that should occupy an intermediate position between these two grades of schools. He also indicated the desire of the Government to provide for candidates for entrance into the schools of arts and trades who could not be admitted to them because of lack of room, and for still another class who, after having been admitted into those schools, were found to be insufficiently prepared to continue their studies in them, and who were therefore turned away.

It happened that just at this time there was vacant the large building of the old convent of Cluny, which had been occupied by a special normal school and the college of Cluny, which had been abolished the preceding year. The village of Cluny owned this building, and it hastened to place it at the disposal of the Government. Three hundred thousand francs ($57,900) were spent in making the necessary alterations and in equipping it for its new purpose.

The present organization and work of the school is regulated by the decree of December 6, 1899, which, however, only introduced minor changes in the scheme at first outlined. Following is a reproduction of the most important provisions of this decree, which sets forth in great detail the conditions of administration, the employment of the time, the character of the instruction to be given, etc.

The object of the school is stated to be the training of a superior class of workmen competent to hold the position of foreman in the metal and wood working industries. It is under the authority of the minister of commerce.

The duration of studies is 3 years. A fourth year is permitted only when a student has been unable to do the regular work through sickness or for other good reason. Certificates of graduation are given to those satisfactorily completing the courses. Those failing to reach the required standard can take a new examination at the end of another

year. A special certificate and a silver medal are given to those passing above a certain grade.

The school receives only boarders, no day students being admitted. The maximum number of students must not exceed 300. The tuition fee is 500 francs ($96.50) a year. The student must also pay 300 francs ($57.90) for his uniform and equipment, and 75 francs ($14.48) the first year and 50 francs ($9.65) each of the other two years for his general expenses. Scholarships and partial scholarships may be granted when the students show that they are without sufficient resources. These are granted for a year only, but are renewable.

Admittance to the school is obtained by competitive examination. The examination is held concurrently in all the chief cities of the departments, and is both written and manual. It includes writing, French composition from the point of view of style and orthography, linear drawing, arithmetic and geometry, physics and chemistry, and the execution, under the eyes of the examiners, of a work in wood or iron. Candidates must be of French nationality and be between the ages of 15 and 17 years.

The instruction given in the school is both theoretical and practical. The theoretical part in all cases is such as has a direct bearing upon iron and wood working, and includes arithmetic, progression, logarithms, and rules of calculation; elementary geometry, including a study of the ellipse, hyperbola, parabola, the development of the circle, the cycloide, and the epicycloide; the elements of rectilinear trigonometry; descriptive geometry; the study of the laws of motion; the various transformations of motion through mechanical devices, and applied kinematics; elements of industrial mechanics—the description of the principal parts of machines and of apparatus and machines employed in metal and wood working; the detailed and complete description of steam engines and hydraulic motors, with explanation of working formulas and notions concerning the strength of materials; physics; electricity and its industrial applications; chemistry; industrial drawing; writing and keeping of accounts; French language; history and geography of France and her colonies; industrial hygiene; moral and civic instruction.

The practical instruction is given in special workshops, and relates to (1) locksmithing or fine ironworking and fitting, with a section for making instruments of precision; (2) joinery and pattern making (two distinct sections); (3) foundry—the execution by all the student molders of articles in iron and copper and of artistic objects, and (4) blacksmithing, boiler making (work in iron and copper). All articles executed by pupils belong to the State.

The teaching personnel includes a director, a subdirector, a shop foreman performing the functions of an engineer, instructors in mechanics, mathematics, physics and chemistry, drawing, French language, his-

tory and geography—and assistants. All receive their appointments from the minister of commerce. There are other officers having administrative duties. Provision is made for a council, composed of the instructors, to act as an advisory board.

Reports showing the standing and work of the students are prepared and sent to their parents each semester. The school must be inspected at least once a year by the inspector-general of technical education.

Upon entering the school the students are definitely distributed among the different shops according to their rank and their particular aptitude. The general principle is to place them in the shop where the work corresponds to the piece of manual work they have executed in the examination. During the last year of study the student pattern makers pass 6 months in the foundry and the student molders execute models under the supervision of the shop foreman and are exercised in taking models to pieces. The student joiners pass 3 months in the fitters' shop and the student fitters 3 months in the joiners' shop.

The character of the daily life of the students—their amusements, expenditures, etc., is very carefully regulated and a rigid oversight is exercised over them at all times. Following is the division of the time of the students during work days: 5.15 a. m., reveille; 5.35 to 5.45 a. m., recitation; 5.45 to 7 a. m., study; 7 to 7.10 a. m., breakfast; 7.10 to 7.30 a. m., recreation; 7.30 to 9 a. m., drawing; 9 a. m. to 12 m., shop work; 12 m. to 12.20 p. m., lunch; 12.20 to 1.30 p. m., recreation; 1.30 to 5.30 p. m., shopwork; 5.30 to 7 p. m., recitation; 7 to 7.20 p. m., dinner; 7.20 to 7.30 p. m., recreation; 7.30 to 8.45 p. m., study; 8.45 to 9 p. m., recreation; 9 p. m., retirement.

The shops of the school are modern in all respects and cover an area of 2,550 square meters (27,448 square feet).

The fitting shop has 150 pupils. Aside from its equipment of smaller tools it contains 43 lathes, 4 fraising machines, a machine for sharpening fraising tools, a drilling machine, a mortising machine, a machine for polishing the interior of tubes, a screw-cutting machine, a machine for rectifying lathe work, and a traveling crane having 3,000 kilograms (6,614 pounds) lifting power and 16 meters (52 feet) carrying space.

The section for work of precision has 18 pupils. It contains 2 drilling machines, a small fraising machine, and 4 thread-cutting lathes.

The foundry, which accommodates 28 pupils, has a traveling crane with a lifting power of 5,000 kilograms (11,023 pounds), a cupola furnace of 1,500 kilograms (3,307 pounds) capacity and another of 1,000 kilograms (2,205 pounds), also a ventilator, a drying stove, a bronze furnace, and a sand-working machine.

The forge shop, accommodating 28 pupils, contains a traveling crane of 1,500 kilograms (3,307 pounds) lifting power, a steam hammer with a drop weight of 1,200 kilograms (2,646 pounds), a steam hammer with

a drop weight of 300 kilograms (661 pounds), and a machine for sawing metals. The machinery and fitting apparatus in the forge shop and foundry are driven by a steam engine of 30 horse power.

The pattern-making shop, which has 30 pupils, is in a separate building. The motive power is derived from 2 turbine water wheels of 10 horse power each. The turbines also run the dynamo which lights the building. A storage battery completes this equipment. A gas engine of 20 horse power is held in reserve, to be used in case of a drought. The shop has 7 lathes for woodwork, a rough-dressing machine, a planing machine, a mortising machine, a band saw, a scroll saw, and a molding machine.

At the boiler-making shop the 15 pupils have at their disposal a pair of shears, a machine for bending sheet iron, and a hole-punching machine. The motive power is supplied by a small horizontal engine of 6 horse power, which also works the apparatus in the laundry.

The budget of the school for the year 1899–1900 was 334,000 francs ($64,462).

INDUSTRIAL INSTITUTE OF NORTHERN FRANCE, LISLE.

This institution was founded in 1873, to take the place of a school of industrial art which had existed at Lisle for some years prior to that time. It was originally designated the "Industrial, Commercial, and Agricultural Institute of the North of France," but the commercial and agricultural sections were abolished and since 1884 the institution has been purely industrial in character. Prior to 1895 it comprised two divisions—technology and mechanical engineering—but in that year the division of technology was discontinued, the first year's course only being retained as preparatory to the work in the remaining division.

The object of the school is to educate young men as mechanical and electrical engineers and factory superintendents for the industries of northern France.

The regular course of study covers 3 years, except where pupils devote a year to preparatory work in mechanical and electrical engineering. The pupils are divided into three departments—that of mechanical engineering, that of electrical engineering, and that of chemistry. The plan of studies is common to all the pupils in the first year; specialization begins in the second year and is greatly augmented in the third year.

The instruction in the department of mechanical engineering is intended especially to prepare pupils for positions as superintendents of machine construction and of public works. It consists mainly of exercises in drawing, adjusting or fitting, joinery work, surveying and leveling, mechanical experiments, and drawing of plans.

The pupils in the department of electrical engineering pursue during the first and second years the regular theoretical course in mechanical engineering, and in the second and third years take up the practical work. They study the various kinds of machines, their construction and their uses. Practical work in electro-technics is begun during the second year and is fully amplified during the third year.

The pupils in the department of chemistry begin the study of analytical and industrial chemistry with the second year. After this they take up the applications of chemistry to the principal chemical industries and are taught to perform experiments and conduct original researches. During the third year the greater part of their time is devoted to work of a practical nature.

Weekly tests are held which stimulate the pupils and show their degree of progress. At the end of the third year diplomas and certificates are conferred on the pupils by the prefect of the department, upon recommendation of the administrative council of the school and the director.

The following table shows the course of instruction and the number of lessons per quarter in each subject:

COURSES OF STUDY IN INDUSTRIAL INSTITUTE OF NORTHERN FRANCE, LISLE.

Subjects.	Lessons per quarter.			
	First quarter.	Second quarter.	Third quarter.	Fourth quarter.
PREPARATORY YEAR.				
Oral courses:				
Elementary mathematics	40	30	30	.....
Descriptive geometry	.....	.....	.....	20
Elements of mechanics	.....	.....	.....	20
General physics	20	20	10	.....
Elements of electricity	.....	.....	10	10
General chemistry	10	10	20	.....
Exercises in mathematics	10	20	10	.....
Exercises in physics	10	10	10	.....
Practical exercises:				
Mathematics	20	20	10	.....
Physics	10	10	10	.....
Fitting and pattern making	.....	30	30	30
Free-hand sketching	.....	.....	10	.....
Chemical experiments	.....	.....	.....	30
Drawing	30	.....	.....	.....
FIRST YEAR.				
Oral courses:				
Elementary mathematics	30	.....	.....	.....
Special mathematics	20	20	30	15
Descriptive geometry	.....	10	10	10
Surveying and leveling	.....	10	10	.....
General physics	20	20	20	20
Theory of electricity	.....	20	20	.....
General chemistry	30	30	.....	.....
Industrial geography	.....	.....	10	10
Industrial bookkeeping	10	10	.....	.....
Practical exercises:				
Drawing	20	30	10	30
Sketching	.....	.....	10	.....
Fitting and pattern making	40	30	.....	30
Chemical experiments	.....	.....	40	.....
SECOND YEAR.				
Oral courses:				
Differential and integral calculus	20	10	10	.....
Descriptive geometry	10	10	.....	.....
Rational mechanics	20	20	10	10
Applied kinematics	.....	10	.....	.....
Construction of parts of machines	.....	.....	10	10

COURSES OF STUDY IN INDUSTRIAL INSTITUTE OF NORTHERN FRANCE, LISLE—Concl'd.

Subjects.	Lessons per quarter. First quarter.	Second quarter.	Third quarter.	Fourth quarter.
SECOND YEAR—concluded.				
Oral courses—Concluded.				
Spinning, weaving, and textile materials (mechanical and electrical engineers)			10	20
Industrial physics	20	20	10	20
Theory of electricity	10	10		
Practical electricity (mechanical and electrical engineers)		10	10	
Analytic chemistry	20	10	10	10
General industrial chemistry			10	20
Mineralogy and geology	10	10	20	10
Common law	10	10	10	10
Hygiene			10	10
Practical exercises:				
Drawing (mechanical engineers)	20	20	40	50
Drawing (chemists)	20	20		10
Drawing (electricians)	20	30	20	30
Free-hand sketching (mechanical and electrical engineers)			10	10
Free-hand sketching (chemists)			10	
Fitting and pattern making	40			
Chemical experiments (mechanical engineers)		40	10	
Chemical experiments (electricians)		20		
Chemical experiments (chemists)		40	50	50
Electrical measurements (electricians)		10		
Electro-technical practice and work (electricians)			30	30
THIRD YEAR.				
Oral courses:				
Applied mechanics	20	10		
Stereotomy	10	10		
Applied resistance	20	10		
Study of machines	10	10	20	10
Study of hand and machine tools	10	10	10	10
Industrial construction	10	10	20	
Railroads		10	10	10
Practical electricity (mechanical and electrical engineers)		10	10	
Telegraphy and telephony (mechanical and electrical engineers)			10	10
Special industrial chemistry (chemists)	20	20	10	
Sugar refining and distilling (mechanical engineers and chemists)	10	10	10	
Bleaching, dyeing, and dressing (chemists)			20	20
Metallurgy	10	10	10	20
Practical exercises:				
Drawing and designing (mechanical engineers)	60	60	60	60
Drawing and designing (electricians)	30	30	30	30
Drawing and designing (chemists)	20	20	20	20
Chemical experiments (chemists)	40	40	30	30
Operations in dyeing (chemists)			10	10
Electro-technical practice and work (electricians)	30	30	30	30

The affairs of the school are administered by a council composed of the prefect of the Department of the North and 15 associates, one of whom is the director of the institution.

On January 1, 1899, the attendance was as follows: Preparatory year, 69; first year, 87; second year, 61; third year, 58; total attendance, 275. The number of graduates in 1898 was 43.

The revenues of the school are derived chiefly from tuition fees, departmental subsidies, and from State and communal appropriations. The total expenditures for the scholastic year 1898–99 were 242,479 francs ($46,798), of which 90,577 francs ($17,481) were paid as salaries to the instructors, etc.

Receipts were 242,786 francs ($46,858). Of receipts the principal items were a subsidy of 20,000 francs ($3,860) from the department,

tuition fees amounting to 150,750 francs ($29,095), and scholarships granted by the State, the department, municipality, etc., to the amount of 50,700 francs ($9,785).

TECHNICAL INSTITUTE, ROUBAIX.

The founding of this institution was due to the initiative of a Catholic priest, the Abbé Vassart, who conceived the idea of establishing a technical institute "for the rational teaching of all the operations connected with the textile industry from the carding and spinning of the raw materials to the dressing of the finished product." In 1895 a stock company was formed to carry out this idea. Two classes of instruction are given in the school.

The first or superior trade instruction is aimed to develop men capable of directing operations in all the different branches of the textile industry, and, through a recently added department of mechanics and electricity, to teach a few pupils the art of engineering. This grade of the instruction, which is both theoretical and practical, is given during the day, and, constituting as it does the principal aim of the school, it gives the institution the character of a higher trade school. The second class or grade of instruction is intended for mill operatives and foremen in the textile industries. It is given only at night. This part of the instruction was free at first, but there is now an annual charge of 5 francs ($0.97) for each course taken.

To be admitted into the day school, candidates must have reached the age of 16, must present testimonials of moral character satisfactory to a Catholic directorship, and show by diplomas or examinations that they have completed the general French or Latin courses of the grammar schools, and have sufficient education to enable them to comprehend the instruction given in one of the departments of the institute.

Students specialize in four departments, in each of which 2 years of study are required in order to obtain a diploma. Each day the pupils pass 3 hours in class exercises and 3 hours in practical work. They must prepare their lessons and exercises outside these hours. The scheme of instruction presents a somewhat peculiar arrangement, in that a general course common to all the students is given, and concurrently with this a specific programme of instruction is used in each of the four departments.

The general course of instruction admits of several subdivisions. The first includes a study of the Catholic religion and the principles of social and political economy, etc. A second subdivision includes courses of instruction relative to the general operation of factories. It comprises a consideration of the qualities of the waters used in the textile industries and the treatment to be given them in different cases, with analyses of waters from different sources; the heating, dampening, and ventilation of factories, as required by the nature of

the products; the production of steam and the different systems of boilers; steam engines and gas motors; general consideration of electricity, its use for lighting and for power, together with the means of generating it, the instruments for measuring it, and apparatus for transforming and applying its energy. A general course in applied mechanics forms another subdivision of the general instruction. In this branch the student is given an idea of the elements of kinematics, supplemented by the elements of general mechanics applied to parts of machinery—rods, shafts, gearings and pulleys, connecting rods, cranks, eccentrics, gear engagements, ratchet wheels, regulators, governors, etc., and elements of strength of materials. A fourth subdivision of the general course of instruction comprises commercial and industrial accounting and the English and German languages; also industrial and art drawing, which is taken by all the pupils independently of the special work in drawing taken up in each department.

For practical work in relation to the general course each special department takes its regular turn at operating the equipment pertaining to the general service of the shops. This general equipment comprises a semitubular boiler of 200 horse power, a steam engine of 40 horse power, a gas engine of 25 horse power, two dynamos having a joint capacity of 36 kilowatts, two accumulators, and six motors for operating the machinery of the several shops.

Of the four departments of special instruction, three relate specifically to the textile industries and are (1) the department of spinning; (2) the department of weaving, and (3) the department of dyeing. The fourth department relates to mechanics and electricity. The following synopsis, based on the programmes in use in each of these departments, shows the scope and character of the technical instruction.

Spinning department: This embraces the combing and carding of wool, the spinning of wool and cotton, and the study of mechanics and mechanical drawing. The work of this department is divided into three parts—the chemical, the commercial, and the mechanical. Each part includes its appropriate technology and its practical exercises. The instruction relative to the chemical side of spinning embraces the consideration of the various waters used and the different methods of purifying them; the oils, their sources and properties, with analyses of mixtures of oils; potashes and sodas, their manufacture and uses; soaps; lubricating oils and oils used on carded and combed wool; the scouring and washing of wool; the chemical properties of the fibers, the removal of burrs, etc. In the laboratory the pupils are trained in supplying and analyzing the waters; in the use of disincrustants, oils, and potashes; in the mixing of fibers in the yarn, and in making soap used in factories.

On the commercial side the work of the pupils in the spinning department includes the study of textile materials of animal and vegetable origin and those of artificial production; studies in relation to the state or condition and the testing of the fibers, and to the numbering of yarns produced from the fibers of different materials from various countries. The practical exercises consist more especially in the preparation of fibers for microscopic examination; testing for hygrometric condition and freedom from natural oil, etc., and the determination of the strength and degree of twisting of a yarn, and of its size and number.

The instruction which is given concerning the purely mechanical part of spinning relates more particularly to the combing and spinning of wool and to cotton spinning. The materials and processes used in the operations of sorting, scouring, washing, carding, combing, spinning, and doubling of wool are considered, as well as are the principles and calculations relative to drawing and twisting and to the installation of the various kinds of spinning frames. Analogous operations in reference to cotton spinning are fully considered. A very complete equipment is provided for the practical exercises in connection with this part of the spinning department. In this department there is more need than in any other that the student shall be familiar with mechanical drawing. For that reason its programme of studies includes a review of those elements of geometry necessary to a comprehension of the plans, cuts, and diagrams of machines, and many exercises in drafting machinery and in drawing to a scale parts of machinery that may call for reproduction in the foundry or woodworking shops. These practical exercises in drawing relate particularly to certain machines or machine parts used in this branch of the industry.

Weaving department: Weaving is studied from the threefold aspect of style, of art in weaving, and the purely industrial or commercial point of view.

Relative to the first of these divisions, a general consideration is given to style in decorative composition, to the distinctive characteristics and the most notable works connected with each style, and to decorative composition as related to the genius of different peoples at various epochs. Styles from the period of antiquity to modern times are studied. The ancient styles considered are the Egyptian, Assyrian, Greek, Etruscan, Graeco-Roman, Chinese, Japanese, Arabic, Indian, Moorish, and Persian. Those which are chosen to represent the middle ages are the Byzantine, Roman, and Gothic. For the Renaissance period, the styles from the time of Francis I to that of Louis XIII are studied; and for the more modern times, the styles from Louis XIV to the Empire are taken as examples. The practical work in relation to styles consists of exercises in decorative composition; copying at sight of a model designed by the professor as typical of a style; invention and execution of a theme in decorative composition under imposed conditions of style, destination, and dimensions; the identification and description of a style from plates; of the tints in the composition, and of the conditions a design must fulfill in order that it may be executed in weaving.

The technological part of the course in artistic weaving comprises a study of the classification of fabrics and the different kinds of looms. The studies in connection with hand weaving relate to the making of double cloths, double-faced cloths, twilled stuffs, fancy fabrics, quilted goods for garments and furniture, piqués, etc. In connection with Jacquard weaving, the students are instructed in making and preparing pattern cards, in producing figured goods and the textures which are made by the use of the drop-box device. A consideration of the different styles of Lyonese beaming, of velvets, gauzes, and tapestries (Gobelin, Beauvais, Aubusson, etc.) complete the technological part of this course. The practical work in the course in artistic weaving includes graduated practical exercises in analysis of the different kinds of fabrics—plain, fancy, figured, and artistic; exercises in making cards after decorative compositions, or after designs obtained by analyzing fabrics, followed by the setting of the loom and the execution of the design. The study of styles and of art weaving is said to constitute a complete preparation for the artisans' examination for the 2 years' exemption from military service provided for by law.

From the commercial or industrial point of view the work in the weaving department comprises the study of the raw materials (wool, cotton, silk, flax, hemp, jute, and ramie), of their application in the manufacture of fabrics, and the operations necessary in such manufacture (twisting, reeling, warping, sizing, tieing, and weaving). Greater attention is given, however, to the details of the construction and the management of the different machines employed. A thorough study is given of all kinds

of looms; of analyses of their motions; of the speed of power looms; of calculation of the output of looms, and of the diagrammatic representation of the action of looms. This course is completed by a consideration of the relations of the manufacturer with the dealers in the raw or spun material, with the combers, spinners, twisters, and dyers of yarns and fabrics, and by some lessons in the proper care to be given yarns, fabrics, etc. The practical work done in connection with this part of the study of weaving consists in exercises in the analysis of fabrics; the production of patterns, including the making of cards, the setting of the loom, the arrangement of the colors, and the weaving of the pattern; and calculations of net cost of weaving.

Department of dyeing: The instruction in this department is divided into three courses, relating respectively to dyeing, to printing, and to the manufacture of dyestuffs. The course in dyeing is in turn divided into several parts. It includes the study of bleaching, of dyeing (as used in the restricted sense), and of finishing. Relative to bleaching a preliminary consideration is given to waters, soaps, alkalies, acids, chlorine, vegetable and animal fibers, and to the effects of the application of different quantities of these substances. Then follows a study of classic and of all the modern processes of bleaching—by ozone, by oxygenated water, chlorozone, barium dioxide, permanganate of potassium, and electricity.

The study of dyeing (as the term is used in the restricted sense) includes the history and description of the processes and materials used; thorough study of mordanting and of the mordants and of dyestuffs of every kind and their application to the various fibers.

The study given to finishing includes a consideration of the materials employed for that purpose; of their nature and of the part they play, from a chemical and mechanical point of view; of the tools used, and of the rules of practice to be followed for the different methods of treatment. Special questions considered in this course relate to certain special processes of dyeing simple or mixed goods, either in the raw state or in various stages of manufacture; the effects of dyeing on the firmness of materials, and accidents in the processes.

The course in printing, after treating generally of the subject of dyeing and of the thickening and coloring materials, takes up the processes of printing on spun yarns (clouding), on combed material, and all processes of printing on the woven fabrics. It treats of the permanency of colors when exposed to physical or chemical agents, and of the wearing quality of the fibers before and after printing. It includes also special lessons in designing and styles for engraving on printing plates and cylinders, as well as in the harmony of colors and taste in decorative composition.

The course in the manufacture of dyestuffs includes lessons relating to the organic chemistry of the fundamental groups of dyes, and to the production, classification, and immediate and elementary analysis of artificial dyes; the study of the preparation of raw materials arising from the distillation of organic matters (coal and coal tar); the study of the manufacture of dyes (extracts of the derivatives of benzine, phenic acid, naphthalene, anthracene, the azoic derivatives, and of certain colorants not derived from coal); the synthesis of the natural colorants; the study of the materials used in the various operations; experiments in devising new processes for making artificial dyes, and analytical methods for investigating the nature and the comparative value of colorants, and for identifying the dyes used on a given pattern. Practical work in this section includes many exercises in dyeing different materials in all the shades, simple or composite; reproductions of scales of colors; the preparation of fabrics for dyeing, and investigations into and analyses of fibers, colorants, etc., employed. All the manipulations involved in printing on yarns, on combed material, and on woven fabrics are performed according to the various methods and styles in use. Students pass over the various operations involved in the distillation of tar for the benzines, naphthalene, phenol, anthracene, etc. They also manufacture chemical products that are used as sources of primary dye materials (anilines, naph-

thols, etc.), make artificial colorants, and make a practical study of the properties and comparative values of the industrial colorants.

The school is well supplied with apparatus for carrying on all the operations of dyeing and finishing.

Department of mechanics and electricity: This department was established more recently than the others for the purpose of allowing certain pupils to specialize in the theory and practice of engineering. The theoretical courses in this department are as follows: Fundamental principles of mechanics in its several branches (kinematics, hydraulics, dynamics, applied mechanics, and strength of materials); comprehensive study of steam engines of all systems, and in particular of expansion gears and their applications. In electricity the studies relate to currents, meters, and sources of electrical energy (piles, dynamos and accumulators), continuous currents, polyphase currents and transformers, electric lighting, power transmission, and electrolysis. For practical work this department has the use of a special shop equipped with vises, lathes, a filing machine, planisher, drill, corrugator, forge and its accessories, and a complete equipment for the construction of electrical apparatus.

A complemental department, in which the instruction relates more particularly to the commercial side of the industry, has recently been added to the school. The instruction comprises special courses in accounting, the study of commercial operations, and of the centers of production and commerce in France and throughout the world, the English, Spanish, and German languages, etc.

Diplomas are awarded to those who satisfy all requirements. They are based upon written compositions made during the course and upon the result of the annual examinations. These latter cover the work of the particular department to which the student belongs and the work of the general course which is common to all students.

Tuition in the day school is 600 francs ($116) a year. A reduction is made to inhabitants of Roubaix. The attendance in 1899 was 60. A boarding department has lately been added for the benefit of students from a distance. The price of board is placed at 1,000 francs ($193) a year, exclusive of tuition.

The evening courses were organized at the beginning of the school's history. They are intended for those workmen and foremen who desire supplemental technical instruction. To be admitted to these courses the applicant must be not less than 16 years of age and have a sufficient degree of primary education to enable him to follow them with profit and take the necessary notes. The courses extend from October 1 to the end of May. The instruction is given in four departments, as in the day school, and covers a period of two years.

The pupils in each department are required to write three compositions the first year. Those students whose work has been satisfactory receive an honorable mention, which entitles them to pass into the second year. In the second year the compositions are followed by an oral examination at the end of the year. Those who are successful receive a "certificate of aptitude."

The evening courses were free in the beginning, but there is now an annual charge of 5 francs ($0.97) for each course. This charge has

the effect of keeping away the idle. In 1899 there were about 200 enrolled in the different evening courses.

Except for private donations of machinery, etc., the stock company has relied upon its own resources for the maintenance of the school. No subsidy has been received either from the State or the city.

The institute has frequently been asked to judge of the merits, or to make trials, of new apparatus, to the profit of the students and of the local industries.

SCHOOLS FOR DECORATIVE AND INDUSTRIAL ART.

A few schools belonging to this class are described in the following pages. It was somewhat difficult to select representative schools for reasons partly explained in the introduction.

MUNICIPAL ACADEMIC SCHOOL, DOUAI.

This institution began its existence January 1, 1770. It was first designated the free school of drawing. In 1808 were added courses in modeling, architecture, penmanship, and botany and anatomy. The courses as they now exist were established in 1881.

The instruction is given in the evening, and is both artistic and industrial in character. The artistic instruction comprises courses in architecture; figural, plant, and flower drawing; painting, modeling, ornamental drawing, elementary drawing, history of art, and anatomy. The industrial instruction comprises courses in machine drawing, stone and wood carving, decorative compositions for painting and sculpturing, wood and iron working, penmanship, and bookkeeping.

The period of instruction is not limited, the pupils remaining at the school until they are fitted to take a position. The following table shows the programme of instruction, the number of hours per week devoted to each course, and the attendance in each on January 1, 1899:

COURSE OF INSTRUCTION AND ATTENDANCE IN THE MUNICIPAL ACADEMIC SCHOOL, DOUAI, JANUARY 1, 1899.

Subjects.	Hours per week.	Attendance.
Artistic instruction:		
Architecture, shading, perspective	13	47
Figural and flower drawing and artistic painting	19½	44
Ornamental drawing, anatomy, and modeling	13½	58
History of art	1½	7
Elementary drawing	6	31
Industrial instruction:		
Machine drawing and applied mechanics	4	27
Joinery and carpentry	4	32
Decorative composition (sculpturing)	6	3
Decorative composition (painting)	15	12
Sciences, physics, and chemistry	4½	3
Wood and stone carving	6½	16
Technical trade instruction	2	23
Fitting, locksmithing, metal turning	10	28
Carpentry, joinery, wood turning	10	14
Bookkeeping (2 hours for boys, 1 hour for girls)	3	38
Penmanship	6	45

The programme of instruction in each course is elaborated by the instructor of that course and the commission charged with the general supervision of the school.

The number of pupils graduating each year varies from 50 to 70. The graduates obtain positions as decorative painters, sculptors, ornamenters, industrial draftsmen, pattern makers, molders, machine fitters, artistic iron workers, metal turners, joiners, carpenters, stone carvers, blacksmiths, masons, foremen of workshops, employees of commercial houses, banks, etc.

The teaching personnel consists of 14 instructors.

The expense of maintenance during the school year 1898–99 amounted to 28,680 francs ($5,535). This expenditure was met by the State subsidy of 9,000 francs ($1,737), and the balance was paid directly by the city.

BERNARD-PALISSY SCHOOL OF INDUSTRIAL ART, PARIS.

In 1882 the municipal council of Paris decided to convert a private drawing school that had been receiving a subsidy from the city into a public school of industrial art. It was named after a celebrated French clay potter of the sixteenth century. Its aim is to turn out skilled artisans for certain art industries—ceramics, wood carving, marble and other stone carving, cloth-pattern designing, and decorative painting.

To secure admission, pupils must take an entrance examination, they must be at least 13 years of age, of French nationality, and residents of Paris or of the Department of the Seine.

The courses are given in the morning and in the afternoon. There are also evening sessions. Tuition is free. The course of study, including a preparatory year, covers four years. During the preparatory year the pupils' aptitudes are discovered, and beginning with the next—that is, the first year of the regular curriculum—their work is specialized. There are separate departments for decorative painters, cloth-pattern designers, carvers, and ceramic artists. The arrangement of the programme is as follows:

Preparatory year: Modeling from plaster casts and from plants; linear drawing; drawing plants and flowers from plaster casts; ornament drawing.

First, second, and third years (the curriculum proper): Department of decorative painting—perspective; theory and applications; history of art and analysis of styles; composition; drawing from large plaster casts; figures and ornaments; study of anatomy; modeling; designing; shopwork. Department of cloth-pattern designing—drawing; history of art; composition; shopwork. Department of carving—perspective; history of art and composition; drawing; study of anatomy; modeling; shopwork. Department of ceramics—perspective; history of art; composition; drawing; study of anatomy; modeling; shopwork.

The total number of students enrolled on January 1, 1899, was 120, of which number 45 were in the preparatory year. The 75 students

in the trade years proper were distributed among the departments and years as follows:

STUDENTS IN EACH DEPARTMENT OF THE BERNARD-PALISSY SCHOOL OF INDUSTRIAL ART, PARIS, JANUARY 1, 1899.

Departments.	First year.	Second year.	Third year.	Total.
Decorative painting	9	5	5	19
Cloth-pattern designing	10	9	4	23
Carving	7	5	4	16
Ceramics	10	6	1	17
Total	36	25	14	75

At this school, as in other municipal schools of Paris, the city has adopted the plan of according aid to certain pupils. The amount of such gratuities depends upon the merit of the pupil and the circumstances of his family.

As showing the value of the instruction here received, it is stated that of the 24 pupils who left the school in 1899, 19 found immediate employment at good wages in industrial establishments. Included in this number were 7 decorators, 4 cloth-pattern designers, 7 sculptors, and 1 ceramic artist. Some of the graduates received a wage of 1½ francs (29 cents) an hour. None received less than 40 centimes (8 cents) per hour. Much the larger proportion of pupils enter the trades for which they are trained in the school.

In 1899 the Society for the Encouragement of Art and Industry organized a competition among graduates of various schools. Prizes amounting to 2,400 francs ($463) were distributed, of which sum two prizes of 500 francs ($96.50) each and two of 50 francs ($9.65) each were awarded to graduates of this school.

The total expenditures of the school for the year ending in 1899 were 75,919 francs ($14,652). Of this amount 58,505 francs ($11,291) represents the amount paid in salaries. The total appropriation of the city was 74,575 francs ($14,393). Departmental and communal appropriations amounted to 1,344 francs ($259).

DISTRICT SCHOOL OF INDUSTRIAL ARTS, SAINT-ETIENNE.

The origin of this school dates from the year 1766, when a course in drawing and carving was established by Jean Olagnier, a talented sculptor of Saint-Etienne. This undertaking developed in 1804 into a municipal drawing school, which in 1886 was transformed into the school as it exists to-day. This transformation was brought about by an arrangement made with the minister of public instruction, by which the school was made a district school of industrial arts and placed under his supervision, thereby receiving an annual subsidy from the central Government. It properly belongs, however, to the municipality of Saint-Etienne and the greater part of its revenues are derived from that source.

Two courses of instruction are offered—one given in the evening and the other during the day. The evening course is general in its character, the instruction relating to the general principles of drawing, anatomy, geometry, and to the history of art, though some instruction is also given in both the theory and practice of weaving and card making. The day courses are intended for young men who intend to enter the trades of decorators, designers, or card makers for the ribbon industry, carvers in building and furniture work, engravers, chasers, etc., and to prepare pupils for the art schools of Paris or for positions as teachers of drawing.

The programmes of instruction for the two divisions, evening and day, are as follows:

EVENING DIVISION.

Elementary geometry: Plane geometry and dependent constructions; solid geometry, measurement of surfaces and volumes.

Descriptive geometry and linear perspective: Demonstrations, diagrams, perspective of simple objects.

Mechanics: Theoretical study of forces and of elements of machinery, and drawings in outline.

Geometrical drawing: Geometrical constructions, outline drawings, sketches, side elevations, principles of wash drawing applied to mechanics, to joinery, to carpentry, and to stonecutting. Pupils pursuing this study must take in addition one of the above-mentioned subjects.

Higher course in weaving: Study of looms and of ribbon weaving in all its aspects, as a whole and in detail.

Course in card making: Study of patterns and of their preparation.

Elementary weaving course: Preparatory work for the two preceding courses.

DAY DIVISION.

Elementary drawing course (first year): Study of geometrical figures and the ornamental combinations derived from them, perspective drawing from observation of the geometrical solids, simple objects and ornamental plaster casts.

Elementary drawing course (second year): Study of architectural fragments, foliage forms, flowers, fruits, and ornaments, from plaster casts.

Intermediate drawing course (first year): Study of ornaments in groups and of the human head, posturing of the body and of the extremities.

Intermediate drawing course (second year): Continuation of the preceding studies, posturing of academic figures.

Higher drawing course: Study of the antique and of the living model, sketching of postures, attitudes, and gestures; ornaments and animals; reductions (the last two subjects being intended chiefly for engravers).

Preparatory course in flower drawing: Elementary study of flowers and plants in charcoal, crayon, and india ink.

Course in flower drawing and decorative composition: Study of groups of flowers and plants, of foliage and fruits, in aquarelle, gouache, and oil; study of decorative elements; general composition—decorative panels, subjects in furniture ornamenting, architecture, etc.; particular composition—ornamentation of sporting and of firearms, special decoration on ribbons and cloths; birds and insects (natural and conventionalized).

Course in modeling and sculpture (two divisions—a morning course from 9 to 12 o'clock for pupils taking the evening drawing course, and an evening course from 8 to 10 o'clock for specialists): Study of ornaments, flowers, plants, figures—from the

elementary to the academic forms; decorative compositions, such as friezes, capitals, consoles, panels, door tops, etc.

Course in architectural drawing: Study of moldings and frames, plans, sections, and elevations; geometrical elevations and diagrams.

Course in engraving, chasing, inlaying, and repoussé work: In this course the chief aim is to inculcate the traditional methods of the artists who have rendered famous the Saint-Etienne industry of firearms decoration, and to teach the processes and the use of the various tools by having the pupils practice engraving with use of the hammer, the scauper, etching with acids, chasing, flat and relief inlaid work chased and engraved. The subjects studied are: Ornaments, letters, figure monograms, emblems, heraldic figures, and the blazonry decorations most generally used, subjects of the chase, and the human figure. The studies are first engraved on flat sheets of steel, then on pieces having the proper contour, such as hammers, trigger guards, locks, levers, barrels, etc.

Course in anatomy: Study of osteology and myology, of proportions, of the model, of expressions and movements; comparative anatomy; drawing in black and in colored crayon.

Course in the history of art: This course covers two years, comprising in the first year a study of the monuments, sculpture, paintings, and decorative arts of Egypt, Assyria, Greece, and Rome, and of the Byzantine, Arabic, and Russian arts; and in the second year study of the Romanesque and Gothic styles, of the Renaissance in Italy and France, and of the period from Louis XIII to the present.

The hours per week occupied by the several courses are as follows:

Flowers and decorative composition	15
Modeling and sculpture	28
Engraving, chasing, inlaid and repoussé work	15
Elementary geometry	4½
Descriptive geometry	3
Mechanics	6
Geometrical drawing	12
Higher course in weaving	6
Card-making course	6
Elementary weaving	8

All instruction in the school is free. The school year extends from October 10 to July 14. There is no boarding department, only day pupils being received. Pupils must be not less than 12 years of age, and must be provided with the certificate of primary education. An entrance examination must also be taken.

The number of pupils in attendance on January 1, 1899, was 402, of whom 199 were taking more than one course, making the total attendance on all the courses 601. The distribution of this attendance, shown for the two sections separately, is as follows:

Evening division:	
Elementary drawing	45
Descriptive geometry	17
Mechanics	14
Geometrical drawing	70
Higher weaving course	31
Card making	13
Elementary weaving course	51
Total	241

Day division:	
Elementary drawing (first year)	60
Elementary drawing (second year)	44
Intermediate drawing (first year)	36
Intermediate drawing (second year)	22
Higher drawing	20
Drawing preparatory to decoration	20
Flowers and decorative composition	12
Modeling and sculpture	24
Architectural drawing	12
Engraving, carving, inlaying	22
Anatomy	44
History of art	44
Total	360

At least one-half of the pupils of this school are employed in the gun shops or ribbon factories of Saint-Etienne, or with sculptors and architects of the city.

The receipts and expenditures for the school year ending in 1899 are as follows:

Receipts:	
Subsidies from the State	$1,544.00
Subsidies from the department	386.00
Subsidies from the city of Saint-Etienne	5,404.00
Subsidies from the chamber of commerce	386.00
Total receipts	7,720.00

Expenditures:	
Personnel	6,880.45
Office expenses	77.20
Course expenses	173.70
Conservatory and flowers	77.20
Furniture and repairs	154.40
Library and prizes	260.55
Living model	57.90
Collection of plasters	38.60
Total expenditures	7,720.00

Besides its general subsidy to the school, as stated above, the city has established two scholarships, one for a designer and the other for an engraver. It also grants scholarships to pupils of the school going to Paris or Lyon to take the courses of the school of decorative arts.

PRACTICAL SCHOOLS OF COMMERCE AND INDUSTRY.

Several representative institutions belonging to this class are described in the following pages. A full description of these institutions, taken collectively, has been presented in the introductory pages of this chapter.

PRACTICAL SCHOOL OF INDUSTRY, HAVRE.

Among the practical schools of commerce and industry that at Havre takes first rank and is often considered as a model for institutions of its class. This school owes its origin to an appropriation of 4,300 francs ($830), made by the municipal council in 1859, for the purchase of tools with which to give manual instruction in locksmithing and carpentering to the pupils of the advanced primary school of the city. Two foremen—a locksmith and a joiner—were employed to take charge of the instruction. This manual training department began operations in October of the following year, 1860. A scheme of instruction was prepared which provided for a three years' course of two hours shopwork per day the first year, three hours the second, and four hours the third year.

This instruction was at first but in the nature of complementary manual training. After several years of experimenting it was decided to convert the manual-training department into an actual trade or apprenticeship school. This was done on January 1, 1868, the new school being installed in a separate building. At first only a modest beginning was made. A director who had charge of the theoretical instruction and two foremen charged with the practical workshop instruction were appointed. The school opened with 46 students. This number continued steadily to increase, from 74 in 1869 to 153 in 1878. The school had at the latter date reached the limit of its capacity and it had become necessary to turn away applicants for admission.

In the meantime it had received considerable elaboration as regards the variety of subjects taught. To the original branches of locksmithing and joinery there had been added courses in drawing, mechanics, blacksmithing, machine fitting, etc. New equipments had been obtained and the number of teachers augmented. The expenditures of the city for the school, which had been 9,270 francs ($1,789) in 1869, rose to 17,480 francs ($3,374) in 1879. The central Government had also contributed liberally to its support.

The great want of the school was now adequate housing accommodations, hence in 1879 a new building was constructed especially for the school. The school in its new quarters was now adequately equipped. Over 217,000 francs ($41,881) had been spent on the building, besides 30,000 francs ($5,790) in addition for the purchase of new machines and tools.

Three additional workshops were constructed. One of these was for copper, tin, and zinc smithing, and small sheet iron working, another for molding and brass founding, and a third for blacksmithing. In 1887 an institution called the school for marine machinists'

apprentices (*l'école d'apprentis mécaniciens de la marine*), capable of accommodating 50 pupils, was annexed to the trade school.

From 1888 to 1892 this school was classed as a manual apprenticeship school, subject to the law of December 11, 1880, and the regulation of March 17, 1888. Since 1892 it has been classified as a practical school of industry, as provided by the law of January 26, 1892, and the decree of February 22, 1893.

The school at the present time is housed in a group of four contiguous buildings. One of these is used for the dwelling of the director. The second, or main building, is a structure 33 feet by 197 feet. On the ground floor are located the shops for machine fitting, for turning, and for locksmithing or fine metal working. The machine-fitting shop occupies about half the space. This shop has 84 vises. The lathes are placed lengthwise along the walls. The locksmithing shop, like that for machine fitting, occupies nearly half of the central part of the ground floor. It has 44 vises. The shops also contain drilling machines, small planing machines, etc. The three shops can accommodate 125 pupils. On the second floor are two carpenter shops, each in charge of a foreman. Each shop has 36 benches with full sets of tools, a lathe, a grindstone, a circular saw (each operated by a motor), two cutting saws, a foot lathe, etc. These two shops can accommodate 80 pupils. The third floor is used for class and study rooms. Here are a library and reading room, two drawing and four class rooms.

A third building is used as a blacksmith shop. It contains 16 forges arranged in pairs, each pair having a chimney in common, and each forge having an anvil and a complete set of blacksmith's tools. Three vises complete the furnishings. Thirty-two pupils can be admitted to this shop. Adjoining the blacksmith shop is a shop for copper, tin, zinc, and sheet-iron working, around the sides of which are benches of masonry provided with 21 vises. Two double forges are so placed that they can be reached from all sides, and are used for soldering and for heating the sheet metal. Two ventilators furnish the necessary draft for the forges and for the foundry. This shop has accommodations for 30 pupils. The building also contains a foundry provided with a cupola smelting furnace of 1,000 kilograms (2,205 pounds) capacity, two crucible furnaces for copper and brass founding, benches along the wall for molding, two cranes, and two vises used in filing the castings. The shop also has a drying stove mounted on wheels and moved on rails, and a traveling crane of 4,000 kilograms (8,819 pounds) capacity for carrying moldings and other heavy articles from one part of the shop to another. This shop can accommodate 30 pupils. A storehouse near the foundry is used for storing coke, sand, patterns, etc. It also contains a sand mill operated by a motor.

A building constructed in 1887 is used for marine machinists' apprentices. The first floor is used for storage purposes. The second floor

contains a chemical laboratory, an amphitheater for lectures, etc., a library, and a museum containing a collection of the best specimens of the pupils' work. The third floor has a mechanical laboratory furnished with 15 desks, and containing a gas motor of 4 horse power for working a dynamo which lights the three rooms on this floor; a steam engine of 20 horse power; a cylindrical marine boiler, and other detached parts of machinery. All these articles are used for demonstrations by the instructors in the course of the lessons. Two class rooms, accommodating 15 to 20 pupils, are also on this floor. The fourth floor contains a drawing room for 50 pupils, used by the machinists' apprentices and by the third-year pupils of the practical industrial school. Since the school has been located on its present site it has never ceased to increase and to improve its instruction materials, tools, machinery, etc.

The expenses incurred by these improvements were borne out of the city budget. The State, however, has also done its part. During the period 1880–1900 the Government granted 50,000 francs ($9,650) in subsidies to the school. The usual amount given annually has been 2,000 francs ($386), but in 1887 it was 4,000 francs ($772); in 1891, 6,000 francs ($1,158), and in 1893, 4,000 francs ($772).

The budget of the practical school for 1900 is as follows: Expenditures borne by the municipal budget, 41,520 francs ($7,975); annual State subsidy, 2,000 francs ($386); department subsidy, 200 francs ($38.60); receipts from the products of the pupils, 10,605 francs ($2,047); total, 54,125 francs ($10,446.60). This amount does not include the salaries of the teaching personnel, which are paid by the ministry of commerce and industry. For the past year they amounted to 19,000 francs ($3,667). The running expenses of the school for machinists' apprentices amount to 11,000 francs ($2,123). They are borne as follows: State subsidy (ministry of commerce and industry), 5,000 francs ($965); subsidy of the Havre Chamber of Commerce, 4,000 francs (772); subsidy of the department, 2,000 francs ($386). The city of Havre bears the expense of maintaining the buildings, providing the tools, fuel, lighting, etc.

The director has the entire management of the school, under the supervision of the departmental inspector, the improvement council (*conseil de perfectionnement*), and the mayor's deputy, who represents the municipal administration in matters concerning public education. The teaching personnel comprises 3 teachers and 3 assistants for the classes; 8 foremen, who are under the orders of a superintendent, for the workshops. Each summer a physician of the town gives ten lessons on hygiene to the pupils of the third year.

The schedule of hours differs somewhat from that of the model programme shown on page 723. In the first place, the time of attendance is shorter, namely, 46 hours per week for the first year instead of

55½ hours; 46 hours per week for the second year instead of 58½ hours; 52 hours per week for the third year instead of 60 hours. It is impossible at the Havre school, which is not a boarding school, to maintain the time schedule prescribed in the model programme. Most of the pupils live some distance away, often several kilometers, and can not, therefore, be at the school at 7 a. m., especially during the winter. The classes are dismissed at 6 p. m., except the third-year pupils, who remain until 7 p. m. The hours of work per week at the shops are as follows: First and second years, 24 hours; third year, 28 hours.

In ironwork pupils are specialized either as fitters or as turners. In the third year the turners do some work in chiseling and filing. Blacksmiths are also specialized. The fitters, locksmiths, and metal turners each have three months' practice at forge work. In the wood-working shop the joiners all have a turn at lathe work and at the fret-working machine. The school does not train specialists in wood turning or fret working.

Instruction in natural history has been dispensed with, but not in hygiene. It has also been deemed advisable to substitute in place of industrial economy an entirely different branch under the name of technology. This consists of the description of machinery, practical processes employed in industry for the execution of all sorts of work relating to the trades of blacksmiths, fitters, turners, joiners, cabinet-makers, locksmiths, and structural-iron workers. For molders, it includes the composition of metals to be fused, the preparation of the smelting furnace, the crucibles, the sand, etc. Instruction is also given regarding the proper conduct of foremen toward the workers placed under them, the reciprocal duties of employers and employees, the orderly arrangement of well-conducted shops, etc.

Special instruction in electricity is given one hour per week for third-year pupils of the superior course. It is optional with pupils of the elementary course.

The following table shows the average number of pupils each year since 1890, in each trade:

AVERAGE ATTENDANCE AT PRACTICAL SCHOOL OF INDUSTRY, HAVRE, 1890 TO 1900.

Trades.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.
Fitters	60	69	63	72	73	70	66	67	76	75	81
Locksmiths	27	43	38	38	43	41	35	35	44	40	45
Turners	13	11	11	12	16	17	16	18	20	22	19
Carpenters	54	66	57	58	62	74	60	67	55	61	49
Blacksmiths	8	5	8	9	9	10	10	11	11	10	11
Boiler makers	19	17	18	14	20	28	25	26	33	35	29
Molders	12	11	16	14	17	20	12	10	22	17	19
Total	193	222	211	217	240	260	224	234	a 259	a 254	253

a This total does not agree with the sum of the items; the figures given, however, are according to the original.

Regarding the subsequent careers of the students, the official report of the school says: "During the course of the year a certain number of students leave the school in order to enter as apprentices the trades which they have adopted. They are led to do this by the temptation of the small earnings to be gained in productive work. Almost all, however, continue in the trades that they had adopted at the school, or at least enter nearly related occupations. The 40 students, on an average, who finish their studies each year are without exception admitted to the construction workshops of Havre or the surrounding district." In order to obtain these positions, for the most part, the recommendation of the director is sufficient.

The following table shows for each year since 1890, the number of students entering the trade prepared for the School for Machinists and other trades after leaving this school. The figures relate only to those who informed the director of the school of their subsequent movements. They embrace all but a few cases, however.

NUMBER OF STUDENTS ENTERING THE TRADE PREPARED FOR, THE SCHOOL FOR MACHINISTS, AND OTHER COURSES AFTER LEAVING THE PRACTICAL SCHOOL OF INDUSTRY, HAVRE, 1890 TO 1899.

Year.	Number entering—		
	Trade prepared for.	School for Machinists.	Other trades.
1890	94	6	12
1891	126	6	13
1892	112	3	11
1893	104	6	10
1894	110	5	12
1895	121	2	13
1896	106	2	10
1897	104	3	11
1898	118	1	10
1899	97	3	16

PRACTICAL SCHOOL OF INDUSTRY, SAINT-ETIENNE.

Saint-Etienne, as is well known, is one of the important manufacturing centers of France. As might be expected, therefore, its practical school of industry has become one of the most important of this class of schools, being scarcely second to that at Havre. The school was opened as a lower-grade school, one for the training of skilled workmen—that is, a trade school proper—in November, 1882, with 54 students. An appropriation of 130,000 francs ($25,090) was made, and a large building owned by the city converted into a schoolhouse.

Several months after a beginning was made in the practical equipment of the workshops. Four foremen were appointed to direct practical instruction in weaving, modeling, machine fitting, and joinery. It soon became evident that the building selected did not furnish sufficient room, so the construction of a new building, on a large tract of

ground belonging to the city, was begun in 1884 and completed in 1885. In the construction of this building the students of the school were actively employed to a considerable extent. After its occupation the students continued to make additions and to work upon the interior fittings. To a large extent, also, the students assisted in making and setting up the machinery that was used to equip the new school. The value of the work done by them was estimated to have been not less than 35,000 francs ($6,755). Since that date the school has secured an extension through the construction in 1893 of shops for weaving and gun making. At its creation the school bore the title of superior primary and trade school. It afterwards became a manual apprenticeship school, under the law of December 11, 1880, and still later, under the law of January 26, 1892, it was changed into a practical school of industry.

The school now occupies two large buildings. The first is devoted to general instruction, and contains 5 study rooms, each accommodating 60 students; 5 recitation rooms, with desks; 1 chemical lecture room, with 150 seats; 1 chemical laboratory; 1 physical lecture room, 1 physical laboratory; 1 room for electrical experiments; 1 large drawing-room, with storeroom for models; 1 library, and 1 museum.

The second building with its dependencies covers 1,400 square meters (15,070 square feet) of ground and contains the workshops. These are on a very elaborate scale and are fully equipped with the necessary mechanical appliances. They comprise a shop for blacksmithing, two shops for machine fitting and building (one for the first year students and one for those of the second and third years), a gun-making and pattern-making shop, a weaving shop, a dyeing and bleaching shop, and a shop for modeling and sculpturing. A 35-horsepower engine furnishes power for driving the machinery. This engine also operates a 20-kilowatt dynamo, which supplies 270 lamps and does other work. The school possesses important collections of apparatus of various kinds. Altogether about 673,000 francs ($129,889) have been spent in the building and equipment of the school, exclusive of the value of the ground. Practically all of this sum was furnished by the city. The only assistance received was a donation of 8,725 francs ($1,684), made by the State, one of 13,000 francs ($2,509) by the Chamber of Commerce on account of the shops for gun making and weaving, and other donations to the amount of 8,000 francs ($1,544). The cost of maintaining the school during the year 1899 amounted to 106,777 francs ($20,608), of which 43,790 francs ($8,451) were borne by the State and 62,987 francs ($12,157) by the city. The contribution of the State, according to the system of dividing the burden of expense in France, is chiefly for the payment of the teachers and other

employees, all but 2,500 francs ($483), which is for the support of the gun making shop, going for that purpose. The school is also the beneficiary of various sums for the support of scholarships. Thus in 1889 a sum producing an annual scholarship of 100 francs ($19.30) was left by one person, and in 1890 a sum of 40,000 francs ($7,720) by another, the income from which was to be used in the form of prizes for the best pupils in this and the practical school for girls at Saint-Etienne. Every year the Chamber of Commerce votes a sum of 300 francs ($57.90), and the textile association gives 100 francs ($19.30) for the same purpose.

The teaching personnel consists of 1 director, 1 general overseer, 10 instructors, 1 superintendent of manual work, 3 shop superintendents, 6 foremen who give their entire time to the school, 2 other foremen who are employed only a certain number of hours per week, and 1 engine and boiler tender.

The course covers four years. The first is a preparatory year, in which the elementary primary education of the pupils is completed. During this year pupils are required to work in each of the shops for the purpose of accustoming themselves to the use of iron and wood working tools, and to do modeling. The work during this year is also intended to bring out the aptitudes of the pupils, so that they can be better able to choose their professions. After this year they are specialized according to their tastes and dispositions.

The time schedule has been necessarily altered from that of the model programme. While the official programme provides for 55½ hours the first year, 58½ hours the second year, and 60 hours the third year, the hours at the Saint-Etienne school are 51½ and 52½, because the distance of the homes of the pupils does not permit them to be at the school at 7.30 a. m. or to remain there as late as 6.30 p. m. It was also thought advisable to allow a longer time for personal work and for study.

The special technical courses taught in this school, which do not appear on the model programme, are textile fibers and weaving, industrial electricity, and the manufacture of firearms. The programmes of these courses cover the following topics:

Textile fibers and weaving: The technological course in textile fibers takes up 1½ hours per week during the third year. It includes brief studies of hemp, flax, ramie, cotton, and wool; the weighing of threads; silk-worm culture, handling of cocoons, study of the properties of silk, the various kinds of silk, their qualities and defects; numbering; scouring; elementary notions of bleaching and dyeing cotton and silk. In this course the instructor aims to give as complete a knowledge as possible of the properties and qualities of the threads which enter into the textures, and he requires the pupils to perform various physical and chemical manipulations in relation to the preparation of fibers with the silk raised at the school.

The course in weaving takes up 1½ hours per week of the first, second, and third years. It covers the whole subject of ribbon weaving, the study of looms, pattern

designing, dyeing, determining the cost of production, etc. The practical work consists of mounting and executing a large number of patterns on different kinds of looms, analyzing samples of the principal kinds of textures, pattern designing, making the design of a pattern and performing all the operations necessary for carrying it out in the woven ribbon; also dyeing and magazine work. The loom work is intended to train the pupil in the manufacture of delicate and difficult work, which is but imperfectly taught to outside apprentices. The pupil is also trained in cloth weaving. The practical work in weaving takes up 22 hours per week the first and second years and 24 hours the third year. The first or preparatory year may be dispensed with if the pupil already possesses the necessary knowledge.

Industrial electricity: This course is taken up in the third year, during which the general principles of electricity are taught, such as the different forms of energy, the conservation of energy, the transformation of heat and of energy into electricity and vice versa, the transmission of power; definition of work, of power, and of units; mechanical equivalents of heat; electric currents and circuits; electro-motive force, resistance, intensity, conductibility, potential, etc.; the volt, the coulomb, the ampere, the ohm, the joule, the watt; exercises and problems; also the study and use of batteries, magnets, solenoids, electro-magnets, mechanical electric generators; the industrial application of currents, as in electric bells, the telegraph, the telephone, electric light, electroplating, etc.

Instruction is given 1 hour per week from October to the end of May. This course is prolonged for 1 year for the benefit of graduates who desire to continue their studies in relation to industrial electricity. Two lessons are given each week during the fourth year. The course comprises a review of the preceding year's work; the principles and uses of accumulators; magnetism and electro-magnetism; the measurements of currents; induction currents; mechanical electric generators; dynamos; electric motors; the application of continuous currents; lighting, generating heat, electro-chemistry; alternating currents, and practical work, such as the application of Ohm's law, constructing batteries, mounting lamps, using the Gramme regulator, measuring with the Wheatstone bridge, the ampere meter, the volt meter, the watt meter, experimenting with a dynamo, a Brown motor, electroplating, etc.

In the workshops pupils construct electrical apparatus, measuring instruments, dynamos, and electric motors according to plans prepared under the direction of the professor of electricity or of the foreman of the shop, and drawings made under the direction of the drawing teacher.

The course in firearms relates to the technology of sporting guns only. It covers instruction regarding the mechanism of a gun; the single and double barrel; the weight of guns of different calibers; the principal systems of guns, such as needle guns, center-fire guns, hammerless guns, etc.; study of cartridges; the manufacture of guns by hand and machine; the manufacture of the barrel, the lock, the breech, and the stock; projectiles; measuring the speed of a projectile; dispersion of the shot; pressure of gas on the interior of the gun; the recoil, etc.

The Saint-Etienne school, like several others of this class, prepares candidates for the schools of arts and trades and the schools for marine apprentices in the navy. Such persons take the same courses as others. During the year preceding the competitive examinations, however, a part of their time is devoted to a review of such work as is covered by these examinations. Thus, if they fail in the competition, they still have a training for entering a workshop like the other pupils.

The following table shows the number of pupils at the school at the beginning of each school year since its creation:

ATTENDANCE AT THE PRACTICAL SCHOOL OF INDUSTRY, SAINT-ETIENNE, 1882 to 1900.

School year.	Total pupils on October 16.	School year.	Total pupils on October 16.
1882–83	54	1891–92	329
1883–84	102	1892–93	325
1884–85	184	1893–94	286
1885–86	216	1894–95	277
1886–87	278	1895–96	296
1887–88	282	1896–97	286
1888–89	266	1897–98	335
1889–90	289	1898–99	353
1890–91	287	1899–1900	406

In the beginning the school received only children of working people and such others as did not succeed in the establishments where they had been placed. Little by little the parents of a higher social standing, foremen, superintendents, employers, etc., sent their sons. For several years the school has been attended by sons of large industrial employers, particularly for preparation for the schools of arts and trades or in the courses in industrial electricity and in weaving.

Nearly all the pupils enter workshops and practice the trades learned in the school. Following is a classification of the pupils by trades during each of the school years 1894–95 to 1898–99:

STUDENTS, BY TRADES, IN THE PRACTICAL SCHOOL OF INDUSTRY, SAINT-ETIENNE, 1894-95 TO 1898-99.

Trades.	1894–95.	1895–96.	1896–97.	1897–98.	1898–99.
Blacksmithing	10	7	10	11	14
Machine fitting	95	100	85	103	114
Gunsmithing	16	20	21	21	38
Carpentering	17	21	22	36	35
Carving	14	9	9	12	7
Weaving	30	33	39	34	32
Industrial electricity	5	5	6	6	4
Total	187	195	192	223	244

There are 32 scholarships, all of which are maintained by the National Government. The school does not board any of the pupils.

In the earlier years it was very difficult to find positions for the pupils. Employers, foremen, and workmen doubted the ability of a school to replace an apprenticeship. Often it required the most pressing solicitations on the part of the director to induce employers to hire the pupils. Even members of the patronal committee were not often disposed to employ them in their own workshops. However, this opposition gradually diminished, and it has become quite easy to find places for them. In fact, requests for pupils are often made

by employers some time before their graduation. Of 738 former pupils whose occupations were reported, 383 became machinists and electricians, 36 carvers, 22 gunsmiths, 81 carpenters, cabinetmakers, and pattern makers, 123 weavers and technical experts in factories, 4 teachers, 2 chemists, 12 clerks, 3 adopted other occupations, and 72 entered the schools of arts and trades, the school at Cluny, and the schools for the training of machinists for marine service.

Statistics of 730 pupils leaving the school, some after three and others after four years' attendance, show that the average wages of the former class were 1.77 francs ($0.34) per day upon leaving the school and 4.50 francs ($0.87) per day at the time of the enumeration. Of those attending four years the average wages were 2.25 francs ($0.43) upon leaving the school and 5.20 francs ($1) at the time of the enumeration. It is estimated that at the age of, say, 20 years ex-pupils of this school receive about 1 franc ($0.19) per day more than persons of similar age trained the old way. It is also worthy of notice that ex-pupils who had attended school four years received 5.20 francs ($1) per day, as against 4.50 francs ($0.87) received by those who had attended only three years. About 50 former pupils have become owners of establishments, contractors, builders, superintendents, and foremen.

Aside from the course for adults established by the city a theoretical and practical course in firing boilers (*chauffage*) was opened by the director in 1886, which he personally directed until the close of the school year 1891–92. When the course in industrial electricity was opened, in October, 1892, the course of boiler firing (*chauffage*) was conducted by two shop superintendents, and later by an additional teacher. These two courses, which are largely attended, are free of charge.

PRACTICAL SCHOOL OF COMMERCE AND INDUSTRY FOR GIRLS, MARSEILLE.

This school is a municipal institution. It was founded in December, 1880, as a purely industrial school, its object being the suppression of the long period of apprenticeship which working girls of that city were compelled to serve in the shops. In 1899 a commercial department was added and the school was placed under the supervision of the ministry of commerce.

In the industrial department the complete course of study covers 4 years and consists of instruction both of a general and of a purely technical nature. The general instruction lasts 3 years and is given in conformity with the official programme for schools of this character except in the following respects: During the first year 15 hours per week instead of 13 are devoted to general instruction, and 1½ hours to study in place of 6; in the second year 16 hours per week instead of 14½ are given to general instruction, and 1½ hours to study in place of 6;

for the third year pupils have 10 hours of instruction per week in place of 10½ and 1½ hours of study in place of 6; during the third year the study of chemistry is replaced by additional work in arithmetic, a majority of pupils being found deficient in that subject.

The trade instruction comprises courses in linen needlework, embroidery, millinery, garment making for men, garment making for women and children, artificial-flower making, corset making, ironing, and shirt making for men. The programme for these courses differs from the official one in that pupils of the first year have 16½ hours of practical work each week instead of 24, and 2 hours of drawing in place of 6; those of the second year have 16 hours per week of practical work in place of 27, and those of the third year 24 hours in place of 30. Instruction in drawing is not provided for the second and third years, but instead, 2 hours per week are devoted to practical lessons in cooking. The fourth or last year is given entirely to the execution of practical work in the shops belonging to the school. This work is brought to the school by patrons and a price is paid for its execution.

In addition to the regular work of the school, there is a course for adults, which is held on Thursday and Sunday of each week from 9 to 11 a. m., and which comprises instruction in the French language, calculations, bookkeeping, cutting and fitting garments for women and children, and practical exercises in sewing.

The teaching personnel consists of a directress, a general supervisor, 5 teachers of scientific branches, 11 teachers of practical work, and 3 persons charged with giving instruction in bookkeeping, drawing, and cooking, all being females.

The school is governed by an administrative board composed of 6 municipal councilors, 3 members of the general council, and 3 persons engaged in commerce or industry. In addition, a supervisory committee of 10 ladies directs in a general manner the practical instruction given in the workshops. There is no charge for tuition, but all pupils except those in indigent circumstances are required to purchase their noonday meal at the school, for which they pay 20 centimes (4 cents). The receipts from this source average about 8,000 francs ($1,544) per year and the proceeds from work executed by pupils about 3,000 francs ($579) per year. These amounts are turned into the treasury of the city.

The cost of operating the school during the year 1900 was 63,500 francs ($12,256), of which amount 7,500 francs ($1,448) was borne by the State and 56,000 francs ($10,808) by the city of Marseille.

The attendance for that year was 304 pupils, divided as follows: First year pupils, 148; second year pupils, 80; third year pupils, 35; fourth year pupils, 41. Of this number 39 received certificates of capability at the end of their third year, and 12 were granted diplomas at the end of their fourth year.

NATIONAL TRADE SCHOOLS.

A general account of this class of schools has already been given. Of the four national trade schools, those at Nantes and Voiron are described below. The school at Voiron is typical of the schools at Armentières and Vierzon. The Nantes school, which was formerly a private institution, differs somewhat from the other three in its plan of organization and scope.

NATIONAL TRADE SCHOOL, NANTES.

This school is the result of the transformation in 1898 of the famous Livet school which, since 1846, had been one of the leading technical schools of the country. Unlike the other national trade schools, the Nantes school does not have attached to it a kindergarten and elementary primary school. It is thus more purely a trade school. This branch of its work, moreover, is organized on a different plan from that of the other three national trade schools. The school is divided into four departments, each having a different end in view. These are: (1) An industrial department; (2) a commercial department; (3) a department for preparing young men for the merchant marine, and (4) a department for preparing student mechanics for the navy. The most important of these is the industrial department. The pupils of each year constitute a separate class, which is subdivided according to needs. In the first year the instruction, both theoretical and practical, is general in character, there being no attempt made at specialization. At the beginning of the second year the pupils are divided into two courses—one for metal work and the other for woodwork—and thereafter remain in their respective shops. In the third year those students who are preparing for the schools of art and trades follow courses the programmes of which correspond to that of the entrance requirements of those schools. The others who desire mainly an industrial training devote themselves largely to shopwork, their other studies being merely complementary to such work. In this shopwork they can specialize for the occupations of machine fitters, turners, blacksmiths, carpenters, and pattern makers. The work in machinery relates especially to marine engines, an important branch of work in the vicinity of Nantes. There is also special instruction relating to electrical machines. It is expected that a great extension will be given to this branch in the near future.

Apart from this industrial department is one of commerce, in which boys are trained as accountants and commercial employees. The programme is based on that of the practical schools of commerce and industry.

There is also a course in hydrography, in which boys from 16 to 19 years of age may prepare themselves for the entrance examinations for the position of student in the merchant marine, a position leading ultimately to that of captain of vessels engaged in foreign trade.

The fourth course receives a limited number of young men for the purpose of preparing them for examination as student machinists in the navy.

No charge is made for tuition, but all pupils must pay at the beginning of each scholastic year the sum of 25 francs ($4.83) to defray cost of supplies and materials used. Moreover, a deposit of 10 francs ($1.93) is required as guaranty against abuse or loss of school property. This deposit is returned at the end of the term, deductions being made whenever proper. Boarding pupils pay 500 francs ($96.50) per year, and day boarders 260 francs ($50.18). In the case of families having several sons in the school deductions are accorded as follows: One-fourth of the cost of board for the younger of two brothers, one-half of the cost of board for the youngest of three brothers. Parents of pupils must provide them with the uniform and other equipments prescribed by the school.

The following statement shows the distribution of students at the school on October 18, 1900, among the different years and departments:

STUDENTS IN NATIONAL TRADE SCHOOL, BY DEPARTMENTS AND CLASSES, NANTES, OCTOBER 18, 1900.

Classes of pupils.	Industrial department.			Commercial department.			Two marine departments.	Total.
	First year.	Second year.	Third year.	First year.	Second year.	Third year.		
Boarders	56	54	50	6	3	.....	8	177
Day boarders	5	5	6	4	.....	.....	1	21
Day pupils	66	16	13	16	8	.....	3	122
Total	127	75	69	26	11	.....	12	320

The school possesses two workshops—one for metal work and the other for carpentry. The machine shop covers 300 square meters (3,229 square feet) and contains a full equipment of tools and machinery for all kinds of metal work. A steam engine of 5 horsepower furnishes motive power for the machinery and also propels a dynamo which lights the buildings. The woodworking shop covers 70 square meters (573 square feet) and contains 20 workbenches and a lathe.

NATIONAL TRADE SCHOOL, VOIRON.

This school is one of three institutions founded by the State under the law of December 11, 1880, to serve as models for other schools of

like character to be established by departments, communes, or private associations. The decree authorizing its creation was issued July 26, 1882, but it was not until October, 1886, that the school was formally opened for the reception of pupils. Like those at Armentières and Vierzon, it was, until April 13, 1900, under the joint administration of the ministry of public instruction and that of commerce and industry. On that date it was, with the other two, placed under the jurisdiction of the ministry of commerce and industry alone.

The school comprises three departments, each of which is practically an independent school and is housed in a separate building. These are a kindergarten, an elementary primary department, and an advanced primary trade department presenting a course of instruction lasting three years.

A small amount of manual work is done in the elementary primary department, but it is of a most rudimentary nature and is intended merely to develop dexterity of hand. The shopwork really begins when the pupil enters the advanced primary department, or trade school proper, at the age of 12 or 13 years. Here it occupies about three hours a day during the first year, four hours during the second, and five hours during the third. No specialization is attempted in the first year, the pupil being occupied at the performance of manual work of a general nature only. At the beginning of the second year the pupil's aptitudes and the wishes of his parents are considered in selecting for him a special branch of trade, and from that time forward his course is directed in conformity with that end.

As at Armentières and Vierzon, the work done is made to conform largely to the special industries of the district in which the school is located. The trade instruction comprises work in joinery, turning and fitting, small mechanics, blacksmithing, weaving, and agriculture.

The programme of theoretical studies is the official one prescribed for schools of this character, and includes the subjects of arithmetic, algebra, geometry, mechanics, penmanship, drawing, natural science, history, composition, grammar, reading, geography, bookkeeping, technology, singing, and gymnastics.

The faculty of the school consists of a director, an accountant, a general supervisor, an assistant supervisor for the workshops, teachers for the scientific and literary branches, a superintendent of shopwork, and foremen for each separate division.

Admission to the trade school is by competitive examination, and is limited to those who have obtained the certificate of elementary primary education. Instruction is free, but a small annual fee is charged for the use of books, tools, and materials. Boarding pupils pay 500 francs ($96.50) a year. There are a number of free scholarships and partial scholarships provided by the State, which are obtained by competition.

The following table shows the attendance at the trade school proper on April 1, 1900:

ATTENDANCE AT NATIONAL TRADE SCHOOL, VOIRON, APRIL 1, 1900.

Classes of pupils.	First year.	Second year.	Third year.	Total.
Day pupils	27	15	4	46
Day boarders	5		1	6
Boarders	63	50	46	159
Scholarship pupils	4	20	9	33
Total	99	85	60	244

The number of pupils in the infant and primary departments averages about 100 each.

The entire ground and buildings belonging to the school cover an area of nearly 10 acres. The accommodations of the workshops are adequate. The carpenters' shop is 420 square meters (4,521 square feet) in area, with benches for 60 workers. The machine shop also covers 420 square meters (4,521 square feet), and holds 104 pupils working at the same time. The forge shop, of 170 square meters (1,830 square feet), accommodates 20 workers. The shop for fine mechanics is a recent addition, and is fully equipped with all necessary tools and machinery. The weaving room, of 420 square meters (4,521 square feet), contains appliances for the practical study of hemp, linen, cotton, silk, and ramie weaving, and accommodates 25 pupils at one time. A small silkworm nursery, annexed to this shop, affords pupils an opportunity of familiarizing themselves with the different processes employed in silk culture. The agricultural section comprises, in addition to various implements and machines used in the practical study of plant culture, a shop for the repairing of wagons and carts. A large number of the tools and machines used in the different shops are the work of pupils. The school is lighted throughout by electricity generated by its own plant, and possesses an excellent system of baths.

TRADE SCHOOLS FOR SEVERAL TRADES.

A practically complete list of trade schools for several trades (group schools) has been presented. This class, as previously stated, has been made to include day schools whose primary aim is theoretical and practical instruction in relation to definite trades or occupations. There is considerable difference shown in the organization of studies in these schools with regard to the relative importance attached to the theoretical and the practical instruction. The character of the instruction has depended entirely upon the views of the different public or private bodies that founded the individual schools, but it is to be noted that

in all of them practical work is given a prominent place. In the following pages several representative schools are described:

MUNICIPAL SCHOOL OF WEAVING AND EMBROIDERY, LYON.

In 1884 the municipal council of Lyon decided to establish a school of weaving. The beginning was made in 1885 when an evening theoretical course and a Sunday practical course were organized. In 1887 the school was reorganized and another year added to the evening theoretical course. In 1888 a practical course for day and evening instruction was opened. In 1889 a third year was added to the evening theoretical course and workshops were established. In 1890 a course in drawing and pattern card making was created, followed in 1892 by a practical and theoretical course in St. Gall embroidery. The object of the school is to give young men practical and theoretical training for the silk-weaving industry of Lyon.

The instruction is divided into the following courses: Day courses in theory and practice of weaving and St. Gall embroidery, an evening theoretical and practical course, a Sunday course in power-loom weaving, and a course in drawing and card making.

The programme of instruction is as follows:

Day course of practical instruction: Cloth weaving and cording; installation of various systems of looms; Jacquard, Verdol, etc., weaving; study of power looms; a course in St. Gall embroidery. The practical work in these courses is supplemented by a certain amount of theoretical instruction.

Evening theoretical course: First year—description of preliminary operations, composition and analysis of woven and corded fabrics. Second year—description of Jacquard looms, card making, ferruling, composition and analysis of figured fabrics, etc. Third year—analysis of figured fabrics.

Sunday course in theory and practice of power-loom weaving: Setting up and taking apart different kinds of looms, practical demonstration on power looms, description of the constituent parts of looms and their relations to each other.

Course in drawing and designing: Copying from models, making sketches, and blending the cording in them, preparing cards.

The municipal council has direct supervision over the affairs of this school. The teaching personnel is made up of 12 instructors.

The attendance on January 1, 1899, was 27 pupils in the day course, 192 in the evening course, 47 in the drawing course, 23 in the Sunday course, and 5 in the embroidery course, making a total attendance of 294. The number of graduates during the past five school years is as follows: 1894, 302; 1895, 303; 1896, 289; 1897, 276, and 1898, 292.

The school's receipts for the year 1898–99 were 35,900 francs ($6,929), derived principally from the contributions of the city, and, in a small measure, from tuition fees and the sale of products of the school. The total expenditures were 33,800 francs ($6,523).

BOULLE SCHOOL OF FURNITURE MAKING, PARIS.

On June 30, 1882, the municipal council of Paris voted to purchase, for 400,000 francs ($77,200), two houses in the Rue de Reuilly (Nos. 25 and 27), with the view of establishing a school of apprenticeship in furniture making. It was not, however, until 1886 that the school was formally opened at the place indicated under the name of Trade School of Furniture Making (*École Professionnelle d'Ameublement*).

Owing to the limited accommodations of the original school building, the municipal council decided in 1889 that a new building should be constructed on a plot of ground in the Rue de Reuilly, Nos. 57 and 59, the estimated value of which was 530,000 francs ($102,290). This ground, with an area of 4,000 square meters (43,055 square feet), answered all the requirements of the projected institution. The work of construction was begun in 1891 and the school was installed in the new building in 1895. The total cost of the building and equipments amounted to the sum of 1,341,635 francs ($258,936).

In 1891 this institution received the name of the "Boulle" school in honor of a famous engraver and wood carver. By a ministerial decree of February 4, 1891, it was put in the class of manual apprenticeship schools governed by the law of December 11, 1880.

The school is governed directly by the city, through a commission composed of members of the municipal council and a delegate from the ministry of commerce. Each year 96 pupils are admitted, 60 to the department of furniture making and 36 to the department of artistic metal working, the latter having been founded within the last few years.

Pupils must be of French nationality, residents of the Department of the Seine, and not less than 13 nor more than 16 years of age. The tests given relate to the subjects embraced in the certificate of primary education. Great weight is given to the mark in drawing.

Breakfast is served from 11.45 to 12.15 o'clock, and is free to pupils who are residents of Paris. Its price to others is 55 centimes (11 cents). The city assists many of the students whose families are in poor financial circumstances. To such students money for their maintenance is allowed in sums amounting to as much as 50 francs ($9.65) a month. Were it not for this financial aid many youths would find it utterly impossible to attend the school.

The personnel consists of a director, a general overseer, an accountant, a subaccountant, a storekeeper, five overseers, and two superintendents, one for furniture and one for metal (bronze) work, with instructors, attendants, cooks, and a janitor. Each of the two main departments—furniture and metal working—comprises a number of subdivisions.

The programme was greatly modified for the school year 1899–1900, particularly as regards the primary instruction. The supervisory committee deemed it expedient to increase the proportion of time allotted to the technical instruction. The primary instruction includes arithmetic, history, and geography. The technical instruction assumes three forms—scientific, technical art, and manual. The scientific course includes industrial economy, technology, linear drawing, and geometry. Under the head of "technical art instruction" are included: The history of art, art designing, modeling, water-color painting, anatomy, and industrial drawing. Lastly, the manual instruction embraces molding in plaster, molding in sand, inlaying, smoothing, blacksmithing, turning, and the trades proper.

In the furniture making department the chief trades taught are cabinetmaking, upholstering, and wood carving. In the metal-working department the principal trades taught are: Metal chasing, with its application to furniture; art bronze work; goldsmiths' work; jewelry work; mounting and engraving applicable to various purposes, but not including the printing industry.

The following table shows the hours per week devoted by the pupils in the various general trades to each course of the technical instruction:

HOUR SCHEDULE FOR TECHNICAL INSTRUCTION IN THE BOULLE SCHOOL OF FURNITURE MAKING, PARIS.

Courses and general trades.	Hours per week.			
	First year.	Second year.	Third year.	Fourth year.
Scientific course:				
Cabinet work	6	5½	6	5
Wood carving	6	4½	4½	2¾
Joinery	6	5½	6	5
Upholstery	6	5	5½	3½
Engraving	6	3	5	4
Metal chasing	6	3	5	4
Mounting	6	5½	5	4
Turning (metal)	6	5⅜	5	4
Technical art course:				
Cabinet work	15	12½	13	11
Wood carving	15	15	14½	17
Joinery	15	13½	13	14½
Upholstery	15	16	15¼	17¾
Engraving	15	16½	14	15¼
Metal chasing	15	16½	12½	15
Mounting	15	13½	14½	15½
Turning (metal)	15	13¾	14½	14½
Manual course:				
Cabinet work	19	33	32	32
Wood carving	19	31¼	32	31¾
Joinery	19	32	32	31½
Upholstery	19	30	30	30
Engraving	19	31½	32	31½
Metal chasing	19	31½	33½	32
Mounting	19	32	31½	31¾
Turning (metal)	19	32	31½	32¼

During the first year, eleven hours per week are devoted to primary instruction in each department.

The courses are supplemented in the case of the best pupils by excursions, in which they profit by observations calculated to develop

their technical training. These visits are, in general, to manufacturing establishments and other works. This reward for the year's work is greatly coveted by the pupils and appreciated by their families.

The number of pupils January 1, 1899, was 248. They were divided as follows: Furniture department: First year, 45; second year, 48; third year, 45; fourth year, 30; total, 168. Metal-working (bronze) department: First year, 22; second year, 17; third year, 23; fourth year, 18; total, 80.

Occasional competitive examinations are given in decorative work, or in the industrial applications of drawing and modeling, and in order to arouse the ambition and zeal of the pupils prizes are distributed in the form of photographs of articles of furniture and works treating of subjects taught in the school. Upon leaving the school, the pupils completing their courses are allowed to take their tools, which facilitates their entrance into shops, since for the most part they would be unable to bear the expense of a new outfit.

Pupils of the Boulle school, like those of similar schools, are favored by the law providing that young men who, before entering the military service succeed in a certain competition may, after 1 year's service, resume their artisan's calling. From 1892 to 1898, 17 pupils were thus relieved from two years of military service.

A diploma from this school is very highly regarded by heads of manufacturing establishments. Many prizes and other honors were carried off in various competitions by the pupils of this school from 1890 to 1899. Its success is further emphasized by an examination into the destination and pay of the pupils after leaving the school. Of 59 pupils leaving in 1898, 50 entered industrial workshops and 1 is an architect. The pupils obtain work at from 3 to 8 francs ($0.58 to $1.54) a day, none receiving less than 3 francs ($0.58). The initial wage is soon increased when the apprentice becomes familiar with the particular requirements of the work in the shop.

The cost of maintaining the school in 1899 was 282,670 francs ($54,555). Of this amount 164,570 francs ($31,762) were paid in salaries.

MUNICIPAL SCHOOL OF INDUSTRIAL PHYSICS AND CHEMISTRY, PARIS.

This school was founded in 1882, after an agitation which lasted two years. During this period a commission was appointed to investigate the subject of the advisability of establishing such an institution, and upon its recommendation a credit of 412,000 francs ($79,516) was voted by the municipal council on July 21, 1882, for fitting up a building and purchasing the necessary apparatus and supplies. The school was formally opened the following October.

The object of the school is to give scientific and practical instruction, and thereby to fit the pupils for practical work in establishments where chemical or physical knowledge is required.

Admission to the school is obtained through a competitive examination, held about the month of July. Candidates must be at least 16 years of age, and not over 19, on October 1 following the examination. The number admitted each year is 30. Pupils not resident in Paris are received, but only in small numbers. These follow the regular courses and may obtain certificates and diplomas of graduation, but are excluded from the benefit of the monthly allowance of 50 francs ($9.65) generally accorded to Paris pupils.

The daily session is from 8.30 a. m. to 6 p. m., with 1 hour's intermission at noon. The school is provided with a lunch room for the convenience of the pupils.

The instruction relates mainly to physics and chemistry, but it has been necessary to introduce mathematics, as the candidates when admitted usually do not have sufficient knowledge of that branch of study. Mathematical studies, however, are treated as auxiliaries merely.

The subjects in which candidates for admission are examined include arithmetic, elementary algebra; plane, solid, and descriptive geometry; physics in its several divisions; general principles of mechanics, gravity, hydrostatics, pneumatics, heat, and electricity; chemistry; and natural history, which, however, has been optional since 1898. It is on these same subjects that the final examinations occur at the close of the course.

The pedagogical organization is well devised and skillfully adapted to the purposes of the school. The first three semesters are occupied in the general and scientific studies and manipulations in class. After the third semester all pupils continue in common the courses in physics and chemistry, as well as the manipulations in electro-chemistry; but with respect to the other experimental work a division is made, the physicists taking their places in the physical laboratories and the chemists in the chemical laboratories. The work of the daily session, excepting the time reserved for lunch and recreation, is constant, consisting of lectures, study, recitations, and laboratory exercises and experiments. Practical work in the laboratories takes up all time not devoted to recitations, etc. During the last three semesters attention is especially directed to technical applications.

By vote of the municipal council on November 3, 1893, there was added to this school a laboratory for study and research. This was equivalent to the establishment of a fourth year. Pupils who hold either the diploma or the certificate of completed studies, which latter testimonial is given to all who have passed the final examinations in a satisfactory manner, are entitled to continue their practical training in this laboratory, or even to undertake private researches.

The equipment is complete, and the young chemists find everything that is necessary in the way of material for experiment. They can also avail themselves of the advice of the special director and of the foreman of practical exercises attached to this laboratory.

The number of students January 1, 1899, was 91. Of the 30 pupils graduating in that year, 25 engaged in industrial work. During the 5 years from 1895 to 1899, 143 students left the school, of whom 111 engaged in careers for which their school training had prepared them.

From the character and value of its instruction, this school is said to hold the first rank among the trade schools of Paris. The pupils whom it sends out from either branch soon obtain lucrative situations in private establishments or in administrative offices, as, for instance, in the railway or the customs service. Their salaries at the beginning are never less than 150 francs ($28.95) a month.

The number of candidates for admission is always considerable, being usually about three times as great as the number of vacancies.

The municipal council has recently voted a credit of 1,300,000 francs ($250,900) for the construction of a new building for the school upon ground belonging to the city.

ESTIENNE MUNICIPAL SCHOOL OF PRINTING AND PUBLISHING, PARIS.

This school was opened in November, 1889. Temporary accommodations were secured in certain outbuildings of the Rollin College and were utilized until a building especially constructed for the use of the institution was completed. Since 1896 it has occupied the new structure, which is situated at Boulevard d'Italie and the Rue de Gentilly. The building occupies a plot of 5,600 square meters (60,278 square feet), of which 3,256 square meters (35,048 square feet) are covered by constructions having a total floor surface of 8,750 square meters (94,185 square feet). The total value of the ground and building is estimated at 1,727,830 francs ($333,471).

The special aim of the school is to revive the industry of printing and publishing, in which the city formerly stood preeminent. Printing presses first appeared in Paris in 1470, and after considerable opposition from the "copyists," whose occupation was threatened, the printing industry became firmly established. During the sixteenth, seventeenth, and eighteenth centuries it was in a very flourishing condition and for a long period the printers and publishers of Paris had no rivals. This superiority was due to the wise regulations of the guild, to the proofs of knowledge and skill required of the printers, the workmen, and the apprentices, and also to the way the apprenticeship was conducted. In the nineteenth century a retrograde movement occurred, and the commanding position occupied by the Parisian printers and publishers was threatened. The causes of this situation

were said to be the disappearance of apprenticeship and the specialization in the various branches of the industry. For this reason the creation of an apprenticeship school became desirable, especially as it came within the general scheme of trade education adopted by the municipal council. On July 20, 1887, in an official report, the end to be reached by such a school was defined in these words: "Your apprenticeship school of printing and publishing should turn out artistic workmen, who will be skilled not only in typography, but also in the arts related thereto." Two days later, by a vote of the municipal council, it was decided to create such a school. The institution was named after a famous family of Parisian publishers.

Admission to the school is obtained by examination, which consists of a dictation exercise, two problems in arithmetic, and a drawing made at sight from plaster. In order to compete, the applicant must be not less than 13 nor more than 16 years of age on the 1st of September of the current year. Candidates must furnish a certificate of primary studies, and must be of French nationality and residents of Paris. Boys living in the suburbs are admitted to the entrance competition upon the condition that their respective communes engage to pay 200 francs ($38.60), which represents the cost of maintenance of a pupil during the first year.

The number of admissions varies, but it has not exceeded 90 for any year. The pupils are not placed in the various trades until three or four months after their admission to the school. In the meantime they are grouped, and each group passes a trial period in all the shops. During this period the work of the pupils is carefully watched with a view to their assignment among the trades. This period of trial does not retard the apprenticeship. The reverse, indeed, is true, since, as a result of it, the pupils are classified according to their special aptitudes and make better progress because of the fact.

The courses of study are of four years' duration. Pupils in engraving, lithography, and photo-engraving may extend their work through a fifth year.

The instruction given is both general or theoretical and practical. The general or theoretical instruction occupies the morning hours from 8 to 12 o'clock. The subjects taught include the French language, history, and geography, the reading of Greek, elements of mathematics and geometry, the physical and natural sciences involved in the arts and trades connected with the publishing industry, history of art and of printing and publishing, modeling, drawing, composition, industrial drawing, gymnastics, and military drill.

The general studies as arranged for the first two years are common to all students. For the third and fourth years, however, the studies are arranged in such manner as to form three special courses, each of which carries branches especially applicable to a certain number of

the various trades represented in the printing and publishing industry. Thus under one course, in which drawing constitutes the principal branch, are grouped those students who intend to become engravers, lithographers, and gilders; in another course, in which French, history, and the elements of the sciences are the principal branches studied, are placed the future compositors, stereotypers, photo-engravers, and binders; while the third course, which carries chemistry and mechanics as the principal studies, is intended for students of type founding and of the various divisions of the presswork typographic, lithographic, and copperplate.

Students in the third and fourth year classes receive this general or theoretical instruction but four mornings each week. The other two forenoons are devoted to practical work. The total hours per week given to each branch of general instruction during each of the four years are shown in the following table:

HOURS PER WEEK DEVOTED TO EACH BRANCH OF GENERAL INSTRUCTION IN THE ESTIENNE MUNICIPAL SCHOOL OF PRINTING AND PUBLISHING, PARIS.

Branches.	Hours per week.				
			Third and fourth years.		
	First year.	Second year.	Engravers, lithographers, and gilders.	Compositors, stereotypers, photo-engravers, and binders.	Type founders and pressmen.
French	2	2		2	2
History and geography	1	1			
History of art and of printing and publishing			2	1	1
Mathematics	1½	1½		1½	1
Physical and natural sciences	2½	2	2	2	2
Industrial drawing and decorative composition	2	2	3½	1½	1
Art designing	1½	2	3	1	1
Modeling	1½	2	3	1	1
Penmanship	1	1			
Gymnastics	1½	1½	1	3½	3½
Total	14½	15½	14½	13½	12½

Practical instruction is given in all the arts embraced in typography, bookbinding, engraving, lithography, photography, etc. It is arranged in such a manner that the apprentice covers one trade in its entirety. It is said to be apprenticeship in its largest and most complete sense.

The time given to practical work amounts, during the first year, to 24 hours per week, during the second year to 30 hours per week, and during the third and fourth years to 36 hours.

For the typographic trades the practical instruction includes type founding, composition and correction, presswork (both hand and machine), and stereotyping and electrotyping. For the bookbinding trades it includes bookbinding and leather gilding, in addition to which special teachers give instruction in edge gilding, marbling, etc.

In the engraving trades the practical work includes wood, copper, and steel engraving and copperplate printing. In the lithographic trades it includes lithography, chromo-lithography, lithographic writing, lithographic designing, and presswork (hand and machine). In the photographic trades it includes photography and the processes derived from it (photo-engraving, photo-typography).

All the pupils breakfast at the school. Those living in Paris are entitled to gratuitous breakfast and lunch; those living outside pay a small charge, though the gratuity is provided for some of them out of departmental funds.

In addition to the regular day classes evening courses are given from October 15 to June 15. At first the evening programme was the same as that of the day school, but it has been much shortened, only those courses attended by a sufficient number having been retained. For admission to these courses the applicant must be at least 13 years of age, or 12 if he holds the certificate of primary studies.

The total number of students enrolled on January 1, 1899, was 228. Of this number 78 were first-year students, 61 were second-year students, 52 were in the third year, and 37 were in the fourth year.

In the five-year period, 1895 to 1899, 406 students had left the school, 205 having been graduated with a certificate of apprenticeship and 201 having left before terminating the apprenticeship. All of those who received the certificate were placed as journeymen in the trades learned in the school. Of the 201 who left before graduating, 138 did so to enter the shops at less than journeymen's wages and the other 63 left to find more suitable employment.

The expenses of the school have been heavy and are increasing each year. In 1900 the cost was 253,205 francs ($48,869), distributed as follows: For salaries, day courses, 161,000 francs ($31,073); for supplies, day courses, 85,455 francs ($16,493); for salaries and supplies, evening courses, 6,750 francs ($1,303).

The city does its best to attract students to the school and to induce them to remain. Scholarships, premiums, and every sort of rewards are accorded them. Every year an excursion for study and observation is arranged for the better students. In 1899 the 12 pupils of the fourth year standing highest in the class were taken to Belgium, where they visited Bruges, Ghent, Antwerp, and Brussels.

Pupils of this school have on numerous occasions distinguished themselves in competitive examinations arranged by the city, the State, or organizations, etc. Some of the brightest students have obtained very high prizes, but it is less by achievements of this nature than by the total and average results that the services of the school are properly to be judged.

The average wages received on leaving the school form a better basis for estimating the results of the instruction. The first class was gradu-

ated in 1893. In a report for that year it was stated that the average wages of the 57 members of the graduating class were 4 francs ($0.77) a day. The average age was 17 years and 7 months. In 1894 the average wages earned by the class of that year rose to 4.25 francs ($0.82). In 1895 the average wages again rose to 4.75 francs ($0.92), but the average age of the graduates fell to 17 years. For the class of 1899 the average wages were reported as 4.90 francs ($0.95), the lowest and highest wage being 3 and 9 francs ($0.58 and $1.74), respectively.

The city governs the institution through a commission composed of municipal councilors and delegates of the ministries and interested associations.

DIDEROT SCHOOL OF WOOD AND METAL WORKING, PARIS.

This school was founded by resolution of the municipal council on May 27, 1872, as an apprenticeship school for the wood and metal working trades. It was located at 60 Boulevard de la Villette, in a district inhabited chiefly by working people, and where conditions were such as to reduce the cost of operation to the lowest figure. The school was formally opened January 6, 1873, with two departments, one for ironworking and the other for woodworking. On November 4, 1873, there was an attendance of 121 pupils. As early as 1879 the reputation of the school was such that graduates experienced no difficulty in securing good positions in establishments of the first rank. By reason of the increase in attendance the capacity of the school soon became inadequate, and for the purpose of enlarging it there was placed at the disposal of the administration in 1877 a supplementary credit of 273,000 francs ($52,689).

The course of study is of three years' duration. Admission is by competitive examination. Competitors must not be less than 13 nor more than 16 years of age, must furnish certificates of primary instruction and proof of nationality and of residence in Paris or in the Department of the Seine. Pupils from the suburbs who pass the examination are not finally admitted unless the communes in which they live will undertake to pay the charge of 200 francs ($38.60) per pupil for the first year. The same is true of the other municipal schools of Paris. The examination consists of a dictation exercise, a composition on a technical subject, two problems in arithmetic, a problem in plane geometry, and free-hand drawing. This examination is held at the school in the month of July. The number of candidates in 1899 was 501.

The shops are nine in number, as follows: Blacksmithing, metal turning, machine and electrical fitting, making instruments of precision, pattern making, coppersmithing, joinery, locksmithing, and sanitary plumbing. Each shop constitutes a single department, with the exception of the shop for machine and electrical fitting, which is divided into three departments. Each department is in chargeof a foreman. The technical instructors or foremen are under the supervision of the director of the shops.

Practical instruction occupies the larger portion of the time. Considerable time, however, is given to technology and drawing.

An important change was introduced some years ago in the operation of the school in regard to the conditions of apprenticeship. First-year students were, on entering, put through a preliminary trial, passing from shop to shop in rotation. It was hoped by this process to ascertain their aptitudes and guide them better in the selection of a trade. In the practice of this rotation, however, there were some quite serious inconveniences, the chief of which was the loss to the boy of about four months' time without any gain in his technical instruction. That trial has been replaced by a restricted rotation, applied only within the limits of a definite industry.

Work in the departments is ingeniously combined. A first-year student is stationed between one of the second and one of the third year students, thus profiting from the experience of his two companions. The learner produces from the start. He turns out a finished article to be supplied to outside order. Thus the apprenticeship is so conducted as to be the least possible tax on the city.

The application and willingness of the student are encouraged. Twice during the year the boys make the same kind of article, without advice or preliminary explanations. A commission of manufacturers and workmen examines and marks the work. Money prizes are awarded to the students whose work is adjudged of highest rank. The supervisory committee of the school arranges visits to large factories, under the conduct of the shop foremen. These visits have an excellent effect and permit a comparison with the work at the school.

On completing their courses the students are not left to themselves. The management of the school concerns itself with securing places for them. It communicates with the heads of establishments, soliciting positions when necessary. Wages are generally low the first few months, and this is to be expected, taking into consideration the boys' ages.

The following table shows the occupations of the pupils leaving the school in 1895 and 1899, respectively, and the average wages received by all pupils in each trade:

OCCUPATIONS AND AVERAGE WAGES OF PUPILS LEAVING THE DIDEROT SCHOOL OF WOOD AND METAL WORKING, PARIS, IN 1895 AND 1899.

Occupations.	1895.		1899.	
	Number.	Average wages per day.	Number.	Average wages per day.
Blacksmiths	3	$0.82	7	$0.97
Coppersmiths	7	.69	4	.70
Fitters	17	.67	24	.74
Joiners	2	.53	7	.72
Locksmiths	4	.63	5	.62
Makers of instruments of precision	7	.74	9	.70
Pattern makers	1	.55	11	.58
Plumbers			6	1.01
Turners	6	.56	5	.71

TRADE SCHOOL AND TRADE COURSES OF THE INDUSTRIAL SOCIETY OF SAINT-QUENTIN.

This society was formed in 1868, for the encouragement of commerce and of the agricultural and manufacturing industries of the locality, and to improve the condition of the workingman. For the education of the laboring classes the society maintains a trade school of iron and wood working, which fits pupils for positions as skilled workmen and factory superintendents in the local industries, and an apprenticeship course for weaving, an industrial museum, and a large number of separate trade courses. The duration of instruction varies from a few months to several years, according to the nature and importance of the subjects taught.

In the trade school of iron and wood working the course of study covers three years and comprises machine fitting, forge work, pattern making and joinery, lathe work, industrial drawing, a course of general instruction, and exercises in gymnastics. The daily session lasts from 7 a. m. in summer, and from 8 a. m. in winter, till 8 p. m., the day's work generally comprising six hours of practical and four hours of theoretical work. All instruction is gratuitous. Candidates for admission must be not more than 16 nor less than 12 years of age, except in case of those holding certificates of primary education who are admitted regardless of age. Accommodations for 100 pupils are provided in the workshops.

The following table shows the subjects taught, the number of hours per week devoted to each, and the attendance on January 1, 1899, in the several schools and courses maintained by the society:

HOURS PER WEEK DEVOTED TO EACH SUBJECT AT THE TRADE SCHOOL AND TRADE COURSES OF THE INDUSTRIAL SOCIETY OF SAINT-QUENTIN, ALSO ATTENDANCE JANUARY 1, 1899.

Subjects.	Hours per week.			Attendance.
	First year.	Second year.	Third year.	
Theory and practice of weaving	21	21	.....	112
Machine weaving	42	.....	.....	12
Machine embroidery	60	.....	.....	16
Linen needle work	48	31	.....	1,109
Practical mechanics	1½	.....	.....	21
Physics and chemistry	2½	.....	.....	23
Sugar refining	1½	.....	.....	21
Firing and boiler tending	1½	.....	.....	26
Decorative designing (ornaments and flowers)	18	18	12	67
Card making for curtains, etc	24	6	.....	45
Card making for embroidery	24	7½	.....	48
Industrial drawing and applied geometry	6	6	6	119
Stereotomy	4	.....	.....	12
Carving and modeling	4	.....	.....	21
Wood and iron working (trade school)	60	60	60	75
Weaving (at Bohain)	1	1	.....	63
Drawing (at Bohain)	1	1½	.....	67
Bookkeeping	1½	.....	.....	19
English language	3	3	.....	48
German language	3	3	3	77

The teaching personnel consists of the director of the trade school and 28 instructors distributed among the different courses.

Upon their graduation, pupils who pass a satisfactory examination receive certificates which usually enable them to obtain good employment in the local industries.

The society receives annual subsidies from the central Government, the department of Aisne, the city of Saint-Quentin, and the local chamber of commerce. Its total receipts for the year ending in 1899 were 74,918 francs ($14,459), of which 41,700 francs ($8,048), were received from the above-mentioned sources.

DE LEWARDE SCHOOL, DOUAI.

At Douai the Brothers of Christian Schools (*Frères des Écoles Chrétiennes*) direct a trade department which was annexed in 1878 to a private primary school endowed by M. Deforest de Lewarde in the early part of the century. This institution was intended to furnish a Christian education to poor children not on the list of indigents. It is conducted by a self-perpetuating council of four. It was originally designed to accommodate 150 pupils, but the attendance in 1899 was 250.

The trade courses are intended to form for the wood and metal working industries intelligent workmen who will be able to take places in the shops of the locality, not necessarily as finished workmen, yet capable of developing into chiefs of sections, foremen, and even small proprietors. Upon their organization the trade courses were attended by only 12 pupils; now they are attended by 42 pupils, 25 in ironworking and 17 in woodworking.

The duration of the regular course of instruction is 3 years, but some leave at the end of 2 years to begin earning wages. The school day includes 8 hours' shopwork and 1½ hours of class instruction. In addition to the technical lessons in relation to their shopwork, the apprentices have a course in drawing of 1 hour a day, and a daily lesson of a half hour in ethics and religion.

The school equipment comprises: In the fitting shop, 5 lathes for thread cutting, 5 ordinary lathes for beginners, 3 boring machines, 1 planer, 20 vises, and a forge; in the joiners' shop, 3 wood lathes, a band saw, a cutting machine, and 14 workbenches, etc. The machinery is driven by a 5-horsepower steam engine. The raw material is provided by the institution, which keeps the proceeds from the sale of the pupils' work.

ST. NICHOLAS SCHOOL, PARIS.

This school is one of a group of institutions known under the collective term "*l'Œuvre de Saint-Nicolas.*" It is directed by the Brothers of Christian Schools, and is one of the oldest and most important of their institutions. It owes its origin, in 1827, to the efforts of the Abbé Martin de Bervanger, who used his personal means in furthering the project. A short while after the school was founded it suffered from a lack of money and the work very nearly resulted

in failure. At this juncture the Count Victor de Noailles became acquainted with the aims and purposes of the institution and gave it his financial aid. He became one of its administrators and for a few years following the revolution of 1830 was its active director. The school was moved in 1833 to what is now No. 92 Rue de Vaugirard, the location it occupies at present. The original idea of establishing apprenticeship shops in the school was now carried out. Six shops were organized, one each for shoemaking, tailoring, typesetting, copperplate printing, pocketbook making, and label and shipping tag making. It is said that this was the first school for manual apprenticeship to be established in Paris. The Count de Noailles died in 1837 and the direction again devolved upon Mgr. de Bervanger, who, in order to obtain a satisfactory teaching personnel, instituted an order of lay brothers named for St. Nicholas. In 1858 the direction of the institution was assumed by the cardinal archbishop of Paris and the administration was intrusted to a council whose members were chosen from the nobility, the judiciary, the French Academy, the bar, commerce, and industry. In 1859 the archbishop requested the superior general of the Institute of the Brothers of Christian Schools to furnish teachers to take charge of the studies. In the latter year the Government recognized the public utility of "*l'Œuvre de Saint-Nicolas.*"

Of the several institutions at present comprising this group the St. Nicholas school is the only one that is of special interest in connection with this report. The institution is capable of accommodating a large number of pupils. Boys are admitted at 9 years of age, and until the age of apprenticeship is reached they are given a primary instruction. Apprenticeship usually begins at 14 years of age. After the primary studies are finished the pupil may, if his parents or guardians request it, enter the industrial section in which he serves an apprenticeship to some trade. At the same time he receives a general or theoretical training in accord with the nature of the trade. The attendance of the school in 1900 was something over 1,000. Most of this number were in the primary classes, about 260 apprentices being at work in the various shops.

There are 12 shops now in operation. They are as follows: A double shop for iron and copper turning and machine fitting; an electrical-working shop; a printing shop; a bookbindery; a shop for map engraving and lithography; one for cabinetmaking; one for wood carving; one for fine mechanical work (instruments of precision); one for metal carving and bronze mounting; one for optical instrument making, and one for trunk making.

The manner in which these shops are operated constitutes the characteristic feature of the St. Nicholas school. The council of administration deals directly with skillful and honest proprietors, to whom it

furnishes the workroom free of cost. The proprietors furnish their own material, their equipment of which they retain possession, and meet all the expenses of lighting, heating, and maintenance, and dispose of the finished product at their own profit and risk. In return the different proprietors engage to teach the apprentices placed under their care all the processes of a trade and to form them into good workmen at the end of three or four years, according to the nature of the trade. The proprietors must be present all the time during working hours, or leave responsible and acceptable foremen in charge during their absence. They are bound to observe the public regulations as well as those prescribed by the direction of the school. They are held responsible for accidents.

Supervision is also exercised by the Brothers, one being stationed on each floor to observe the conduct of the work and of the apprentices. Each apprentice is generally required to furnish his own kit of small tools.

From his entrance into the shop the apprentice does useful work. It is the aim of the management to make conditions as nearly as possible like those found in regular industrial establishments, without, however, the loss of time to the apprentice from running errands, etc. He must be given work proportioned to his strength and degree of advancement. The proprietor is required to tell him the piece price for making the object which is given him to do, and how long it would take a good workman to do it, thus enabling him to know his degree of advancement. Proper safeguards are provided to prevent the too frequent repetition of the same work, that is, specialization. The most profitable work is that which can be done only by pupils who have advanced farthest in the trade; hence it is to the proprietor's advantage to make the instruction thorough. The aim is to fit the apprentice so that when he begins work in the manufacturing establishments, etc., he will be prepared to go ahead as if he had served his apprenticeship there, but with a more complete knowledge of his trade.

Strict discipline is maintained, but there are, properly speaking, no punishments. If certain requirements are not met the apprentice is refused his monthly leave of absence. This and the threat of dismissal are the only forms of restraint in use. By way of encouragement the proprietors generally allow a small money gratuity, which, as the apprentice becomes proficient, amounts to 4 or 5 francs ($0.77 or $0.97) a week. Eight hours constitute a day's work in the shops. Besides shopwork under the proprietors the pupils receive instruction in general or technical subjects, drawing, etc., which is given by the Brothers. Two hours a day is devoted to this general instruction.

The institution is conducted on the boarding-school principle. The fees are 50 francs ($9.65) for entrance and a monthly payment of 35

francs ($6.76), the latter covering the cost of lodging, board, clothing, washing, books, medicine, and medical attendance. If the pupil contracts a contagious or chronic disease, however, he is sent home. The principle of contracting with employers to furnish a trade education to apprentices is very similar to the system followed in the industrial school at Tournay, Belgium. In the present case, however, with two exceptions, the workshops are located in the school building and the apprentices are under a closer supervision by the school authorities. Each shop, which may be said to constitute a separate institution, will be examined in detail.

The machine shop occupies a space of about 400 square meters (4,306 square feet) on the ground floor, but two gas engines each of 15 horse power and the gas generators are placed in the basement. The shop is divided into two parts by a partition wall. One division is used chiefly for work in copper and its alloys, the other for ironworking, etc. They are well equipped with the necessary machinery, etc. Both divisions are under the direction of one firm. Their management, and that of the engine rooms, is in charge of a competent overseer. The proprietors themselves are frequently on the ground and keep in close touch with the work.

The apprentices in the machine shop are separated into three classes—copper turners, iron turners, and fitters. In 1900 there were 14 apprentice turners—6 in copper work and 8 in ironwork—each class having its own foreman. The fitters numbered 38 or 40. These work alternately in copper and iron, and are under two foremen, one for each specialty. Apprenticeship in these shops is of four years' duration.

The apprentice proceeds by easy stages from the most ordinary labor to that requiring a high degree of skill. This gradual development of the apprentice is well outlined by M. Émile Cail in his report, previously mentioned, on the private Catholic institutions. Speaking of the apprentice fitters, he says:

At first the apprentice is required to take the rough edges off machine pieces, partly with a mortising chisel or a graving tool, partly with a file. Thus he becomes acquainted with the forms of the parts and, aided by explanations, with the processes of their manufacture, whether cast or forged. Next he will dress some surfaces which do not require a very fine adjustment. Thus he gradually acquires precision in the use of the file. Meanwhile he becomes acquainted with the use of the drilling machine and the polisher and with the processes of screw-cutting, etc. At the end of his first year he will have a thorough knowledge of his tools and the ability to do simple fitting.

In his second year the apprentice undertakes the fitting of somewhat complicated parts; spends more time in making tracings of parts after plans and side sketches, and extends his knowledge of the machinery, operating, when necessary, the planer, mortiser, filing machine, and corrugator. In regular industry these machines are generally placed

in the hands of a particular class of workmen, while the fitters have only to finish the parts by hand, assemble them, and set them up in place.

In the third year more precision and finish is required in the apprentice's work, as he has to fit parts that are to move one upon the other. He begins to assemble the different parts of a machine in such manner as to secure the greatest possible regularity in their combined operation.

Finally, in the fourth year he undertakes the fitting of the most difficult parts and the most complicated machinery and acts as guide to his less advanced fellows, thus proving and perfecting his knowledge by teaching.

The stages in the apprenticeship of the turners in iron and copper are analogous to those of the fitters.

In each division of the machine shop the apprentices are taught the processes of forging, tempering, and annealing and sharpening their tools. The making of automatic lubricators, steam gauges, etc., constitutes the principal manufacturing enterprise that is undertaken in this shop, but the establishment is also able to produce machine tools for various uses. A part of the equipment of the shop is the work of the apprentices; thus a large drilling machine and three lathes were entirely built by them and turned out with accuracy and finish. They also constructed the two gas engines in use. Repair work for outside parties is done in this shop and constitutes a means of increasing the students' knowledge. Such work is intrusted only to the most advanced pupils.

The electrical shop was organized by the proprietors of the machine shop in 1898. It is well equipped with modern machinery. In 1900 12 apprentices were at work, under a special foreman, making various parts of electric-lighting apparatus. Apprenticeships last four years.

The printing shop is organized and operated exactly like an ordinary printing establishment and is equipped for executing every class of work. Its chief product, however, consists of bookwork.

All the work is executed by the apprentices under the direction of 2 foremen, 1 pressman, and 1 proof reader. The apprentice is instructed in all that pertains to composition and presswork. The beginner sets type from printed copy until he has acquired rapidity. After one or two years he is allowed to enter upon the work of making up, and later of imposing the whole form. After each set of proof sheets has been read and corrected by the proof reader and author the apprentice is required to make the indicated changes on the galleys or pages. Successive revisions are made until the author signifies that the work is in condition for the press.

For the actual work of printing the equipment includes several presses of modern type, among which are three perfecting presses. They are operated by a gas engine which is installed in the basement. The apprentices acquire a knowledge of all the details of operating

these machines—preparing the form and making ready for the press, etc. When a large number of copies are to be printed, electrotype plates are used. The plates are prepared by outside establishments, but the operations are explained to the apprentices.

In 1900 there were 36 apprentices in the printing shop, 22 of whom were engaged more particularly in composition, 10 in presswork, and 4 (selected from among the most skillful pupils) in making up and imposing. In both divisions (composition and presswork) the apprenticeship covers three years.

Apprenticeship in the bookbindery covers three years.

Although the sewing of the signatures is generally done outside the establishment, the apprentice is, nevertheless, instructed in this operation. He may begin the apprenticeship by working either on new work or by rebinding old volumes. He is gradually taught the different steps in the process—the rolling, pressing, sawing, sewing of the volumes, etc. By the end of the first year he is working on ordinary editions. During the second year he learns to round, shape, and glue the backs, etc. He is then given work of a higher grade and is taught something about gilding on leather and gilding the edges of books. While the apprentice will rarely find occasion to perform these latter operations in Paris, where they constitute a special trade, his knowledge of them will be an advantage should he go to the provinces.

In the third and last year the apprentice perfects himself in the several parts of the trade of bookbinding. He begins to bind *éditions de luxe* in the different styles, the principles of which are explained to him in full detail before he proceeds to apply them.

The graduates easily find employment, either in Paris or in the provinces. Some have become foremen in large establishments and some have become proprietors. The number of apprentices in this shop in 1900 was 14.

In the map-engraving and lithographing shop the apprentices work under the same direction. They employ in great measure the same principles, notwithstanding the different application of them. Both groups begin in the same manner, at first copying samples of penmanship and guiding themselves by the use of a mirror. They learn the properties of the stone on which they are to operate. The stones are prepared sometimes by the ordinary engraving process, while at other times the design is raised on the surface of the stone by tracing over it with a special kind of ink or ink crayon, then washing in a preparation which fixes and renders the ink insoluble in water. The latter is a much cheaper process.

The distinction between the two trades is based, not on the method of operation, but on the kind of drawing to be traced. The map engravers are given exercises in reproducing to a different scale, in the conventional forms of and variations in letters, and in representing mountains, etc.

The lithographers, in preparing for commercial work, learn the different styles of handwriting in current use; the make-up of the vignette, both by engraving and the other process above mentioned; the arrangement of letter heads and billheads, and stippling for chromo-lithography.

The apprentices learn by practice how properly to manipulate the sheet at each successive impression when more than one color is used. Apprenticeship in each trade is of four years' duration. In 1900 there were 16 apprentices in this shop—5 in map engraving, and 11 in lithography. The map engravers generally find employment in Paris or in some other large center. The force in the cartographic office of the ministry of war is composed largely of former St. Nicholas apprentices. They generally begin work at a wage of 4½ or 5 francs ($0.87 or $0.97) a day, but soon afterwards obtain from 8 to 10 francs ($1.54 to $1.93), according to individual skill. The lithographers, it is said, receive about the same wages, but they find employment much more readily, as their knowledge qualifies them for service in a greater number of establishments.

The shop for joinery and cabinetwork is one of the two shops not located in the school. The apprentices are placed with a firm that manufactures furniture, carved chairs, etc. The length of the apprenticeship is three years. It is the director's duty, besides giving the technical instruction and correcting the pupils' work, to train them in reading plans and to cultivate in them the appreciation of the forms adopted in the different styles of furniture. The programme is as follows:

During the first year the apprentice becomes familiar with the tools, and is exercised in sawing and rough planing wood and in making joints. During the second year he passes to plain scarfing or jointing, working on chairs, frames, drawers, small tables, etc. In the third year he does work requiring greater skill, such as the mounting and finishing of furniture, tables, sideboards, credences, beds, cupboards, wainscoting, etc.

The number of apprentices in this shop in 1900 was 20. On terminating their apprenticeship they very easily obtain employment in Paris at a wage of 60 centimes (12 cents) an hour.

The wood-carving shop is also located outside the school building and is managed by the same proprietors that train the apprentice cabinetmakers, but a special foreman is placed in charge of the carvers. The programme of apprenticeship, the full term of which is four years, is as follows:

The first six months are occupied in acquiring a knowledge of the general principles of the trade, and in learning to handle the tools, waste pieces of wood being used for the purpose. During the next six months the pupils begin productive work on plain moldings deco-

rated with heart-shaped leaves, beads, or ribbons, and also attempt simple corbels in rose work. In the second year they undertake more complex moldings, such as godrooms, shellwork, and leaves of acanthus, laurel, or oak; then rose work, plain work on chairs, etc. In the third year they begin on the more difficult parts of chairs—arms, curved back pieces, and crooked feet; then openwork gallery trimmings and elaborate consoles, passing finally to the execution of more advanced work, outlined by the pupils of the fourth year. In the fourth year the work is principally on friezes, plasters, panels, wainscoting, columns, and capitals.

Ornamental design constitutes an important part of the instruction. In the workshop the apprentices are surrounded by numerous well-selected models which serve as a means in the development of taste. Most apprentices remain in the trade of wood-carving. Some, however, take up carving on stone and after a little practice become proficient in the art.

The graduates readily find employment. The wages received on leaving the shop are never less than 60 centimes (12 cents) an hour. Those apprentices, however, who have an artistic gift in addition to their technical knowledge soon obtain better remuneration. Some of the more gifted graduates have become, when quite young, foremen in large establishments. The number of apprentice carvers in 1900 was 25.

In the metal-chasing and bronze-mounting shop the apprentices are divided into three classes—metal chasers, bronze mounters, and lathe workers. The metal-chaser's work, briefly stated, consists in finishing castings of bronze or brass in the form intended by the designer. It requires the removal of the seams, tap holes, air holes, etc., from the casting and the finishing of every part and detail in an artistic manner.

The bronze-mounter's work consists in assembling the separate casts or pieces of which an object is composed. During the apprenticeship the boys learn to trace out and prepare the surfaces which are to be joined; the method of heating the parts and the care to be taken to guard against deforming them; the proper method of applying the solder, and the filing down, tempering, and flushing of joints necessary to secure a perfect finish. In this work a thorough knowledge of linear drawing is a great aid to the apprentice. Some of the mounters engage in electrical and automobile work after terminating their apprenticeship.

A three years' apprenticeship is required in each division. It is said the apprentices, although often far from being accomplished workmen, are so well prepared when they leave the shop that they readily become good workmen. The metal chasers are able to earn 4 to 5 francs ($0.77 to $0.97) per day, while the bronze mounters are said to earn 4 to 6 francs ($0.77 to $1.16) per day on leaving the shop.

In 1900 there were 18 metal chasers, 8 bronze mounters, and 3 lathe workers serving an apprenticeship in this shop.

The shop for instruments of precision or fine mechanics is directed by a firm that manufactures and perfects scientific instruments and instruments of precision which, by reason of the delicacy of their parts and the accuracy required of them in their operation, call for perfect and careful adjustment.

In 1900 the shop contained 22 apprentices. Aside from the equipment of large tools with which the shop is supplied by the contractors, each apprentice has an individual kit of tools for which he is held responsible. Part of these hand tools are made in the shop by the apprentices. The processes of instruction are much the same as those mentioned in connection with the description of the machine shop. An important difference is that whereas in the machine shop the fitters and the turners form two distinct classes, in this shop the apprentice learns both the fitting and the turning. He is also taught to polish, to nickel plate, and to varnish the parts that he makes.

The apprenticeship is of four years' duration. Upon its completion the graduate knows the trade well enough to practice it in any branch, which makes it easy for him to obtain employment. He is qualified to enter an establishment for the manufacture of telegraphic, electrical, or optical apparatus, telephones, water, gas, or electrical meters, registers, or recorders, photographic apparatus, cinematographs and phonographs, and laboratory instruments, such as saccharimeters, spectroscopes, microscopes, or instruments used in astronomical work and navigation—sextants, compasses, etc.

The wages obtained by the graduates immediately after leaving the school are rather low, being generally only 40 centimes (8 cents) an hour, but they are rapidly increased, and often reach from 75 centimes to 1 franc (14 to 19 cents) per hour.

Apprentices in this shop are included in the class of artisans who may compete for exemption from two years of military service.

It has been seen that apprentices in this shop do all the operations necessary in the production of a completed instrument. While they do not specialize in the school as do the apprentices in the ordinary machine shop, specialization is often required in actual business. This is particularly true of the turning required in the manufacture of optical instruments; hence the need of a shop for the special training of optical turners who become specialized in this particular branch of fine mechanics.

Apprenticeship in the optical instrument turning shop lasts four years, and the apprentice is developed in the same manner as in the other shops. He begins by making the springs, then the screws, eyepieces, parts for receiving the lenses, etc. He is also instructed

in making his own tools. He begins with the bar of steel, forging it in the form of the tool desired, which he then tempers, anneals and sharpens. In his last year he is intrusted with putting together the separate parts of an article.

Although especially trained for one class of work, the graduates can do various kinds of work outside their specialty. The processes being identical, they can make the separate parts in many sorts of apparatus used in physical laboratories, in telephone work, telegraphy, photography, electrical installation, the utilization or measuring of gas, etc., or they can apply their special skill in an instrument manufactory. On leaving the school, they can obtain 5 or 6 francs ($0.97 or $1.16) a day. If they have aptitude, however, this wage is gradually raised to 9 or 10 francs ($1.74 or $1.93). This shop has been nearly thirty years under the direction of one firm. It contained 12 apprentices in 1900.

The trunk-making shop was established previous to 1859. It was reorganized in 1899, and is occupied exclusively in the finishing of trunks and valises. The valise frames and trunk boxes are bought ready made and are trimmed and finished in the shop.

The apprentice begins his course by sewing leather handles. Then he pastes and makes up the cheapest sort of valises, then jointed valises with iron or leather corners, then successively leather hat-boxes, cloth valises, leather valises, etc. In the second year he takes up all kinds of fine valise work, as trimmings of pigskin, sheepskin, or parchment, and the making of ordinary leather trunks. In his third and last year he works on fine leather trunks and various fancy articles belonging to the industry.

Wages in this trade are not very high; yet it is not difficult for graduates to obtain a wage of from 40 to 55 centimes (8 to 11 cents) an hour on leaving the school. In 1900 the number of apprentices in this shop was 20.

Aside from the regular eight hours' shopwork, the apprentices are required to spend two hours a day in class exercises. These exercises are arranged in such manner as to afford as nearly as possible a suitable complementary instruction to the apprentices of each shop. The instruction is chiefly in drawing applicable to the various industries or groups of industries represented in the shops, but other subjects are touched upon. The apprentice has previously been more or less prepared for the apprenticeship, in so far as the theory is concerned; hence it is only necessary to emphasize during the first year of apprenticeship some elementary principles that are particularly involved in the practice of the trades taught.

There are three drawing courses, each covering three years. They are—(1) a course in mechanical drawing for the apprentice machinists,

instrument makers, optical turners, and electrical workers; (2) industrial drawing intended more particularly for the apprentice cabinetmakers; and (3) a course in decorative and art designing for the apprentice lithographers, map engravers, wood carvers, metal chasers, and bronze mounters. The apprentice compositors, printers, binders, and trunk makers each join the course best suited to their individual aptitudes. There is also a more elementary course for those who can not take one of the courses above enumerated.

The detailed programmes of these courses are as follows:

Mechanical drawing: First year—Sketches and outlines taken directly from machine parts. Elements of kinematics. Exact drawing to scale from sketches. Second year—Kinematics continued. Plans and drawings of working parts of machinery. Strength of materials. Third year—Outlines of engines. Steam engines, gas engines. Machine tools.

Industrial design for woodworking: First year—Object drawing, using customary wooden objects. Simple groupings (*assemblages*). Exact drawings to scale from sketches. Second year—Descriptive stereotomy. Studies of furniture. Sketches of furniture. Third year—Stereotomy applied to carpentry. Sketches from nature and from drawings (furniture, staircases, etc.). Composition according to specifications.

Art and decorative design: First year—Drawing from copy, plaster casts, and engravings. Elements of decorative composition. Second year—Drawing from busts. History of ornamentation. Elements of decorative composition. Third year—Study of the human form and of decorative figures. Study of the classification of styles. Ornamental composition with reference to modern house furnishing and to the decorative arts.

While there are no regular courses in theory, special lessons in the technology of their trade are given the apprentices at different times, as required in the development of their work.

MARTIN SCHOOL FOR GIRLS, LYON.

The institution known as *l'École la Martinière des filles* was founded in 1879 in accordance with the testament of Major Martin, who left a legacy for the establishment of an institution for educating children of the city of Lyon. Its object is to give a superior primary and trade education to girls graduating from the primary school.

The school term lasts from October 1 to July 15.

The regular course of study covers a period of three years and is pursued uniformly by all the pupils, the forenoons being devoted to general and the afternoons to technical instruction. Pupils who complete the three years' course may spend a fourth year at the school, devoting the entire day to the practical work.

The branches of general instruction are reading, grammar, French language, history, geography, drawing, mathematics, physics, chemistry, and domestic economy. The special courses are commerce, stenography and typewriting, industrial drawing, embroidery, and dressmaking.

The following table shows the number of hours per week devoted to each trade course:

HOURS DEVOTED TO EACH TRADE COURSE IN THE MARTIN SCHOOL FOR GIRLS, LYON.

Trade course.	Hours per week.			
	First year.	Second year.	Third year.	Fourth year (optional).
Industrial drawing	17½	17½	17½	35
Embroidery:				
Pattern drawing	10½	10½	10½	21
Embroidery work	10½	10½	10½	21
Dressmaking	17½	17½	17½	35

The hours per week devoted to the other special courses are—to commerce, 17½ to 19½ hours; to stenography and typewriting, 17½ hours.

The school possesses a very complete equipment of materials for instruction and an excellent library.

The board of administration of this school is composed of the mayor of Lyon and four associates. The teaching personnel consists of nine instructors. At the end of the third year examinations are held before a board made up of professors and persons engaged in business and industry in Lyon, and diplomas are given the pupils who obtain a good general average. Prizes and bank accounts are awarded at the end of each year.

The attendance figures for the five years ending January 1, 1899, do not show much variation. On that date the total attendance was 182. Of these pupils 106 were in the commercial and 76 in the industrial courses.

The expenditures of the school for 1899, amounting to 40,000 francs ($7,720), were entirely covered by the legacy of its founder.

MUNICIPAL TRADE SCHOOL FOR GIRLS, RUE FONDARY, PARIS.

This school was established in 1881. Its object is to teach young girls certain trades suitable to their sex, and at the same time to instruct them in the duties of housewives.

The regular programme of instruction covers three years and comprises courses in dressmaking, linen needlework, millinery, embroidery, corset making, artificial-flower making, garment making for children, and ironing, the last-named course being of two instead of three years' duration. The number of hours per week devoted to each of these courses is 30 for the first year, 35 for the second year, and 41 for the third year. The course in ironing consumes 30 hours per week during the first and 41 hours per week during the second year. There are besides special courses in cutting and fitting, embroidery work for under-garments, and shirt making. In addition to these special

trade courses there is a general course which all pupils must take and which comprises advanced primary instruction, bookkeeping, drawing and water-color painting, and cooking and practical instruction in domestic economy. The school possesses a full equipment of all materials needed for instruction. Its affairs are administered by a commission composed of members of the municipal council, persons engaged in industry, and a representative from each of the ministries of commerce and of public instruction.

Pupils must be not less than 13 nor more than 15 years of age, except in the case of those holding certificates of primary education, who are received at 12 years of age. An entrance examination is taken by all. Tuition is free to residents of Paris of French nationality. The attendance upon the various trade courses of the school on January 1, 1899, is shown in the following table:

PUPILS ATTENDING EACH TRADE COURSE IN MUNICIPAL TRADE SCHOOL FOR GIRLS, RUE FONDARY, PARIS, JANUARY 1, 1899.

Trade course.	First year.	Second year.	Third year.	Total.
Dressmaking	43	37	30	110
Linen needlework	11	4	3	18
Embroidery	5	8	3	16
Artificial-flower making	3	4	4	11
Corset making	4	5	5	14
Ironing	2	3	2	7
Millinery	8	11	5	24
Garment making for children	10	10	7	27
Total	86	82	59	227

The number of pupils graduated in 1898 was 62.

The revenues of the school are derived from subsidies granted by the city of Paris, from departmental and communal appropriations, and from the sale of articles made by the pupils. In 1899 the receipts were 102,155 francs ($19,716) from the city, 208 francs ($40) from the department, 5,048 francs ($974) from other communes, and 10,063 francs ($1,942) from work of pupils, making a total of 117,474 francs ($22,672).

THE ÉLISA LEMONNIER TRADE SCHOOLS FOR GIRLS, PARIS.

The Society for the Maternal Protection of Girls was organized in 1856, with Mme. Élisa Lemonnier as president. Its aim was to secure homes for young girls in indigent circumstances and to teach them a trade by which they might make a living. It placed several children in Paris and others in Germany, but, having nowhere found homes that fully met their views, the members of the society determined in 1862 to open special training institutions. At that time the society enlarged its sphere of activity and took its present title of Society for the Trade Education of Women. It founded in the Rue de la Perle the first trade school for women in France. This school had great success, and others, modeled exactly after it in programme and details of organization, were opened one after another. Later the society adopted the

plan of developing especially two of its schools and giving these an equipment and programmes which would make them model schools. The first of these was founded in 1864 and is located in the Rue Duperré; the other, founded in 1870, is in the Rue des Boulets. The society owns the buildings in which both schools are installed.

In these schools the courses open on the first Monday in October and close August 2. In addition to the industrial and commercial courses proper, each school gives general courses, covering the following subjects: French, arithmetic, geometry, history, geography, sciences, writing, and sewing. The direction of each school is intrusted to a woman, and most of the teachers are women. The curriculum of trade education covers four years, the commercial three years. Following is a list of the branches taught in the industrial department of each school and the number of hours per week devoted to each:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE INDUSTRIAL DEPARTMENT OF THE ÉLISA LEMONNIER TRADE SCHOOLS FOR GIRLS, PARIS.

Subjects.	Hours per week.							
	Rue Duperré School.				Rue des Boulets School.			
	First year.	Second year.	Third year.	Fourth year.	First year.	Second year.	Third year.	Fourth year.
Drawing	18	18	18	18	14	9	9	18
Perspective	1½	3	3	3	.....	2	2	4
Geometry	1	1	1	1	8	.....	.....	.....
Descriptive geometry	.....	1	1	1	.....	.....	.....	3
Anatomy	.....	2	2	2	.....	.....	3	3
Decorative composition	2	2	4	4	6	6	6	6
History of art	.....	1½	1½	1½	.....	.....	2	2
Engraving	.....	4	4	4	.....	.....	.....	.....
Small figure work	.....	4	4	4	.....	2	2	2
Fan decoration	.....	2	2	2	3	3	3	3
Miniature work	.....	3	3	3	.....	.....	.....	6
Water-color work	.....	2	2	2	.....	3	3	3
Enamel and ceramic decoration	.....	2	2	2	.....	2	2	2
Artistic leather work	.....	.....	.....	.....	2	2	2	.....
Painting on glass	.....	.....	.....	.....	3	3	3	.....
Embroidery	.....	.....	.....	.....	27	27	27	27
Sewing	16	22	22	.....	22	22	22	.....
Cutting	3	5	5	.....	3	.....	5	.....
Pattern making	1	3	3	.....	2	2	2	.....
Embroidery pattern making	.....	.....	.....	.....	2	2	2	.....
Arithmetic and geometry	4	4	4	.....	4	4	4	.....
Physical and natural science	2	4	3	.....	2	3	5	.....

The attendance on January 1, 1899, was 422 pupils, distributed as follows: Industrial course, 266 pupils; commercial course, 92 pupils; preparatory course, 64 pupils.

The general studies are taken by all the pupils alike.

The Society's receipts for the year 1898–99 are reported as follows:

Subsidies:	
From the State	$2,026.50
From the city of Paris	4,632.00
From trade unions	19.30
From various associations	376.35
From individuals	4,059.76

Gifts for particular ends	$559.87
Assessments of the 368 active members	1,980.47
Pupils' fees	4,952.17
Sales	5,487.74
Scholarship funds:	
Departmental	234.50
Communal	911.92
Miscellaneous	244.68
Total	25,485.26

The expenditures exceeded the total receipts by 2,993 francs ($578).

Each year general competitions are held, open to the pupils of the two schools. They enter other contests also, such as those of the Central Union of the Decorative Arts, those held under the ministry of fine arts for the different degrees of professor of design, and art or industrial expositions, etc.

TRADE SCHOOLS FOR SINGLE TRADES.

There are comparatively few genuine trade schools in France in which the instruction is limited to a single trade. A list of them has already been given. It is undoubtedly true that the instruction in some of these schools relates to an industry in which, in actual practice, the work is specialized, but this specialization does not exist in the instruction given at the schools. It is considered better to have a wide general knowledge of the trade to which the instruction relates than a specialized training in some particular branch of it. Several representative schools belonging to this class are described in the following pages in the alphabetical order of the occupations taught:

APPRENTICESHIP SCHOOL OF THE ASSOCIATION OF CARRIAGE WORKERS, PARIS.

This school was established in 1888. Its aim is to take boys finishing their school education and give them an apprenticeship which will make of them skilled workmen in the carriage-making industry. The instruction comprises five distinct departments—joinery, wheelwrights' work, fitting and blacksmithing, carriage upholstering and trimming, and painting. Instruction is given each day in all these branches by five teachers, each having one department. Apprentices devote two hours per day to theoretical and practical work in each department, or a total of sixty hours per week. The term of apprenticeship is three years, and for the services they are able to perform during this period the young men receive a remuneration of from 1.50 to 3 francs (29 to 58 cents) a day.

On January 1, 1899, the total number of apprentices at the school was 15. Since 1895 employment has been found for an average of 5 apprentices each year.

The receipts for 1899 consisted of a subsidy of 3,000 francs ($579) from the city of Paris and assessments of members of the association amounting to 1,692 francs ($327), to make up the balance of a total expenditure of 4,692 francs ($906).

FRENCH SCHOOL OF HOSIERY, TROYES.

This school was founded in 1888 by the local chamber of commerce and the association of hosiery manufacturers and employers in related industries. It receives aid from and is under the control of the National Government and the general council of the Department of Aube. At first the school was subsidized by the municipal council of Troyes, but since 1896 it has received no support from the city. By means, however, of the subsidies from other sources this school renders important service to the local industry by educating persons for positions such as overseers and superintendents of mills. It does not aim to train operatives.

The administrative board is composed of members of the chamber of commerce and of hosiery manufacturers of Troyes.

The school term opens at the beginning of October and closes at the beginning of August. The curriculum covers two years. The programme of studies and hours per week are as follows:

First year: Elementary study of textiles, first principles of spinning, of weaving, and of the technology of hosiery manufacture, 2 to 3 hours; mathematics—elementary geometry, arithmetic, including progressions and logarithms, 4 hours; drawing—geometrical drawing, sketches and drawings of machine parts, 6 hours; practical work in hosiery manufacture, 20 hours; practical work in machine fitting, 10 hours; history and geography, 1 hour.

Second year: Technology of spinning, weaving, and hosiery manufacture, 2 to 3 hours; mathematics applied to industry, 11 hours; industrial drawing, 6 hours; practical work in machine fitting, 10 hours; shopwork in hosiery manufacture, 14 hours.

The programme of most of this second year's work is given in fuller detail, as follows:

Technology: Elementary principles of cotton and wool spinning; visits to shops in connection with technology of hosiery manufacture.

Mathematics and physics: Summary of elementary algebra, including equations of the second degree and their discussion; elementary geometry; elementary descriptive geometry and its applications; kinematics, as complete as possible; general precautions to be taken in operating machinery; principles of industrial mechanics, mechanical work, levers, strength of materials; general principles of industrial physics; elementary principles of the industrial applications of electricity; steam generators and engines, gas engines, gasoline engines, hydraulic engines.

Industrial drawing: Drawing from outlines made by the pupils, or following specifications given.

Attached to the school is a knitting mill with a complete equipment for instruction in hosiery manufacture, a machine shop containing vises, a forge, a foot lathe, and a hand boring machine, besides numerous smaller tools, and a library.

Examinations are held at the close of each semester covering all

the subjects taught. A pupil whose work is unsatisfactory at the end of the first year is not admitted to the higher division. Those who pass the final examinations receive diplomas.

The number of pupils attending the school varies from 14 to 18. Young men without means are received gratuitously, and the four obtaining the highest averages on a competitive examination receive an allowance of 200 francs ($38.60) the first year and 250 francs ($48.25) the second. These allowances are called residence scholarships (*bourses de séjour*), and are intended to assist the families of the holders to supply their needs during their attendance at the school. They also partially compensate the young men for the loss of wages they might earn during that period.

The total receipts of the school for the year 1899 were 14,022 francs ($2,706). Of this amount, the principal items were 3,000 francs ($579) from the State, 2,000 francs ($386) from the Department of Aube, 2,500 francs ($483) from the chamber of commerce, and 4,730 francs ($913) from the association of hosiery manufacturers.

SCHOOL FOR MINE BOSSES AND FOREMEN, ALAIS.

The idea of a school for the training of mine bosses originated with the mayor of Alais, who laid before the common council of the city a proposition to establish a school of such character. The subject was afterwards taken up by the general council of the Department of Gard, and the creation of the school was finally authorized by a royal ordinance issued September 22, 1843. On July 25, 1845, the minister of public works promulgated the regulations that should govern the school, and in November of the same year the first students, 13 in number, were admitted.

The organization of this school has received but unimportant modifications since its creation. The idea of preparing men who should engage in the actual operations of mining as bosses rather than engineers or directors has never been lost sight of, and the instruction given has consequently always been thoroughly practical. The school is now governed in accordance with the decree of July 18, 1890. The most important changes introduced by this decree over the provisions of the ordinance of 1843 relates to the composition of the teaching staff and the minimum age of admission. Under the regulations now in force the director of the school must be a chief engineer of mines. He has under him two special teachers, a master overseer (*maître surveillant*) and a steward (*économe*). All four of these assistants must be selected from the class of mine controllers (*contrôleurs des mines*) and be appointed by the minister of public works. There is also a teacher of French, who is appointed by the prefect of Gard.

The school is supported in part by the State, the Department of Gard, and the city of Alais, as the tuition fees received are wholly

inadequate. The tuition fee, including board and lodging, is 400 francs ($77.20) a year. Most of the students, however, are in receipt of scholarships. The minister of public works has five at his disposal, and the Department of Gard has eight. Others are given by different departments and mining companies.

The students of the school are recruited mainly from among the mining population of the district in which the school is situated and to a less extent the other mining districts of France. Their ages at entering vary from 18 to 25 years, and they must have had at least 18 months' actual work in coal mines. As the number of students is limited to about 45, and not more than from 20 to 25 students can be admitted each year, a selection of the persons to be received is made by means of a competitive examination.

During the month of July all candidates are first examined in the arrondissement in which they reside. Those who are successful in this examination can take the final examination for admission, which is held at Alais. This latter examination includes a test of the candidates' ability in reading, writing, and arithmetic, but particularly relates to their practical knowledge of mining operations. Candidates can also request to be examined concerning their knowledge of algebra, geometry, trigonometry, physics, and chemistry. Preponderating weight, however, is given to their knowledge of practical mining operations. Usually about 55 to 65 persons take the preliminary examination. Of these, from 40 to 45 are permitted to take the Alais examination, and from 20 to 25 are admitted as students. The official reports note that during the past ten years there has been a distinct rise in the level of the intellectual attainments of the candidates.

The course of instruction lasts two years. Its most significant feature is that the students are not taken entirely out of the mines during this time, as it is believed to be very desirable that they should continue in the closest touch with mining work. The students thus pass but 6½ months of each of the years at the school. During the remaining 5½ months they are sent as ordinary laborers or mine measurers. The instruction given consists of the French language; the elements of algebra, arithmetic, and geometry, as far as these studies are necessary for an understanding of practical mine operations; special courses in topography, physics, and chemistry; mechanics, mineralogy and geology, and the exploitation of mines; linear drawing, as well as a certain number of practical exercises relating to topography, geology, and industrial drawing.

In addition to these regular courses, there is a special course open to the ten students passing highest in the examinations. This course is given by a mine controller residing at Alais, and consists of one lecture a week upon the law of mines, quarries, steam boilers, etc.

The purpose of this course is to fit the student for the duties of mine controller, though the information imparted is of use to all classes of mine workers.

The 6½ months of each year devoted to studies are broken up into two periods, one of 4½ months during the winter and the other of 2 months during the summer. During these months the students board at the school. They rise at 5 o'clock in the morning and retire at 9 in the evening. Each day they have two sessions, one of 3 hours and the other of 1½ hours, in addition to three lessons in French of an hour each during the week. The remainder of the time is passed in study, recreation, and meals.

Following is a more detailed statement of the character of the technical courses:

The course in surface and underground topography consists of 20 lessons. The study is pursued entirely with reference to its application to mining. Twice a week, during the summer months, the students go into neighboring mines, where they pass through all operations relating to underground surveying. Once a week they have practical work in surface topography. Reports of plans are subsequently considered in the class-room exercises.

Physics and chemistry are taught entirely by the experimental method. The course includes 16 lessons in physics and 20 lessons in chemistry. In physics especial attention is given to natural forces and to principles made use of in mines. In chemistry the study is restricted to a rapid survey of the principal properties of the metals and metalloids and the description of the methods of analysis of combustibles, of fire damp, and of the principal metals. The study of each metal is accompanied by instruction regarding metallurgical operations involved in its transformation from the raw ore to the finished product.

The course in mechanics and machinery embraces 29 lessons. The first few lessons consist of a study of the theoretical elements of statics, kinematics, and dynamics necessary to understand simple machines and steam engines. The subsequent exercises relate to the description of machines and engines. Two lessons are devoted to the strength of materials. Once a week the scholars go to industrial establishments of the neighborhood where they study and make sketches of machines or parts of machines. They also make drawings of mine machinery, etc.

Instruction in geology and mineralogy is given in 28 lessons, numerous examinations of the collections ordered by the school, and eight days spent in field work. The course is divided into four parts. The first includes the indispensable general ideas of geology; the second, the study of rocks and minerals; the third, an elementary study of strata; finally, the fourth, a study of the principal coal basins of France

and of the different kinds of coal deposits. Use is made of numerous photographs in this course.

Thirty-eight lessons are devoted to the subject of the exploitation of mines. This course is purely descriptive. Only practical mining operations are considered, and work being carried on in the neighboring mines is constantly referred to by way of illustration.

During the months that the students are working in the mines they are given different classes of duties to perform. On returning to the school they are required to make a report on what they have done.

By means of frequent examinations and other tests the relative standings of the students are carefully recorded. Four-fifths of the graduates highest in rank are exempted from two years of military service. A decree dated January 2, 1883, permits the three students standing the highest to be appointed mine controllers without passing any other examination.

There can be no doubt that the school has admirably fulfilled the purposes of its establishment. During the period from the date of its foundation to the close of 1899 it has prepared 852 students. Of these, 116 are dead, and no information is obtainable concerning 193. The careers of 543 are definitely known. Of these, 197, or 36.3 per cent, occupy the post of boss miners or directors of particular services; 98, or 18 per cent, are mine measurers; 165, or 30.4 per cent, occupy various positions of responsibility—assistant engineers, directors of small works, etc.; 40, or 7.4 per cent, are engineers or directors of important works; 41, or 7.5 per cent, are controllers of mines or superintendents of roads and bridges; 2, or 0.4 per cent, are officers in the regular army. Fourteen per cent of these persons reside in foreign countries, of whom one-third are in Algeria and Tunis, one-third in Spain, and the remaining third scattered throughout the world.

SCHOOL FOR MINE BOSSES AND FOREMEN, DOUAI.

The school for mine bosses and foremen at Douai was created by decree of March 27, 1878, in response to the request, and promise of financial aid, of the two great mining departments of the Nord and Pas-de-Calais. The purpose of this school is strictly analogous to that of the school at Alais that has been described. To carry out that purpose almost the same scheme of organization and programme of studies has been adopted. The following description of this school is taken from the very interesting account prepared for the Paris Exposition of 1900, and published in the Journal Officiel of July 30, 1900. It shows not only the organization of the school but the intensely practical spirit in which it is administered and the happy results that have been obtained.

The purpose of the school is to take young men who already have an acquaintance with the practical features of mining and give to

them the training fitting them to occupy the positions of mine bosses, mine measurers, etc. A few of the more intelligent students continue their studies after graduation and rise to higher posts in the state service or private industry, but the great majority have no other expectation than to become subordinate officers in mines.

Candidates for entrance must be at least 18 years of age, have had eighteen months' experience in coal mines, and be in possession of a satisfactory primary education. The school receives only boarders, the cost of tuition, including board and lodging, being 500 francs ($96.50) a year.

The school is directed by a chief engineer of mines, and instruction is given by three teachers who must each have the grade of controller of mines. The duration of studies is two years, and, as at the school at Alais, about half this time must be spent in practical work in the mines. The greater part of the theoretical instruction is given during the first four and a half months, from October 15 to March 1. The students then perform mine work for two months, returning to the school May 1. Here they remain for two months reviewing their previous work and studying the results of their mine experiences. They then return to the mines for the three and a half months, from July 1 to October 15.

Of this union of theory and practice the director of the school says: "The practical instruction that the mines in active operation give to students of the school of Douai has this immense advantage, that it is constantly in touch with the progress of the art of mining. It is extremely profitable to the students without costing anything to the school. The rule according to which the companies employ them, which is that they are paid according to the work done and not according to the wage scale in vogue, renders their employment easy. It has this additional advantage, that it does not permit the students to have any illusions concerning the real services which they are capable of rendering."

The programme of studies is practically identical with that of Alais which has already been given, and need not therefore be repeated.

The school accommodates about 45 students. During the last nineteen years, or from 1880 to 1898, 248 students have completed the course. The situation of these students in 1899 was as follows: 14 had died, the occupations of 7 were unknown, 13 occupied various positions on tramways, railroads, etc., while 214 were engaged in actual mining operations. Of these 214, 12 were controllers of mines in the Government service, 117 were bosses, foremen, assistant engineers, engineers, or directors in mining companies, and 47 were mine measurers, chief mine measurers, or office employees. With rare exceptions the students upon graduation enter the mines as ordinary miners or laborers and work their way up. This, however, on account of their training, usually requires but two or three years at the most.

TRADE SCHOOL FOR SHOEMAKERS, PARIS.

This school was founded in 1891 by private initiative. Its object is to give to young men desiring to devote themselves to shoemaking a practical training in that occupation and to offer to young workmen from the provinces instruction that will better fit them for the class of work required in the city.

Two courses of study are provided—a practical course in shoemaking, extending over the entire year and lasting from 8 a. m. to 7 p. m. each day, and a general evening course in cutting from December 1 to August 20, which consumes two hours per week. Apprentices of the shoemaking school also receive general instruction at night in a communal school.

A limited number of these are day pupils, some of them being boarders. On January 1, 1899, the attendance upon the school was 30 pupils, of whom 18 were regular apprentices and the remaining 12 special students.

The school receives subsidies from the State, the city, trade unions, etc. Tuition fees and the proceeds from the sale of work executed by the pupils also go to swell the receipts of the school. The expenditures for 1899 were 5,147 francs ($993); the receipts for the same year were 4,477 francs ($864), leaving a deficit of 670 francs ($129).

SCHOOL OF THE APPRENTICE TAILORS' PATRONAL COMMITTEE, PARIS.

This school was founded in 1893 by a committee of the Employers' Association and of the Benevolent Society of Master Tailors of Paris. The object of its founders was to give to the class of employees called pieceworkers such practical instruction as would better fit them for their work, thus proving of mutual benefit to employers and employed. The practical course in garment making covers three years and consumes 60 hours per week.

In addition, the committee has established courses in cutting and technics, which occupy 2 hours on Monday and Friday of each week. In these the young men receive technical lessons in measuring, cutting, trying-on, fitting, lining, etc. These courses open at the beginning of November and close at the end of April. The programme in detail comprises the preparation, lining, padding, etc., of garments; needlework and stitching; lining, joining, and modifications in work depending upon the kind of cloth used; geometrical relations in the cutting and making-up of garments; study of methods of making alterations, etc.

The teaching personnel consists of 2 teachers in the workshops, 2 in the technical course, and 2 in the course in cutting. The school is equipped with all the necessary tools and has a permanent exhibition of work done by the pupils, which serves for models, etc.

Each year the apprentices are examined by a jury of tailors. The number of pupils attending this school in 1899 was 25. The receipts and expenditures for that year were as follows:

RECEIPTS AND EXPENDITURES OF THE SCHOOL OF THE APPRENTICE TAILORS' PATRONAL COMMITTEE, PARIS, 1899.

Receipts.	Amount.	Expenditures.	Amount.
Subsidy from the State	$57.90	Personnel	$185.28
Subsidy from trade organizations	96.50	Compensation to teachers, supplies, lighting, examinations, and presents.	276.69
Subsidy from individuals	189.14	Surplus of receipts	93.87
Proceeds accruing to school from sale of work	154.40		
Miscellaneous	57.90		
Total	555.84	Total	555.84

INDUSTRIAL SCHOOL OF TEXTILES, TOURCOING.

This school was founded in 1889, to meet the requirements of the local spinning and weaving industry. It undertakes to give young workmen and employees such theoretical and practical instruction as will fit them to become overseers, master workmen in spinning and weaving, bookkeepers, heads of offices, etc., in textile establishments, and to give to the sons of textile manufacturers and merchants such complete technical instruction as will enable them to assume the management of their fathers' establishments.

The instruction comprises two divisions—a day school and evening courses. The latter are for persons who are employed during the day and hence have only the evenings for study. The day courses are for the sons of manufacturers and merchants who can devote their entire time to their studies.

Each of the evening courses covers a period of from one to three years, according to its importance. The studies in each of the day courses cover one year, but the weekly hours are arranged so as to permit pupils to take branches in more than one course, and thus complete the programme of instruction in two years. The school year begins October 1, and ends July 15th or 20th.

The programme of instruction for the day as well as for the evening courses comprises spinning, weaving, mechanics, and commerce. The number of hours per week devoted to the work of each course is as follows:

HOURS PER WEEK IN EACH COURSE OF THE INDUSTRIAL SCHOOL OF TEXTILES, TOURCOING.

Courses.	Hours per week.			
	Evening classes.			Day classes.
	First year.	Second year.	Third year.	
Spinning	3	3		7
Weaving	4½	4½	5	20
Mechanics	4	4½		7
Commerce	4			4
Decorative art applied to weaving (optional)	6	6		

Pupils of the day courses generally enter the school for the purpose of taking certain studies which they can finish in one year, after which they enter upon the occupations of their parents. About one-half the pupils who matriculate in the evening courses do not finish them on account of bad health, change of employment or residence, military service, etc. Those who complete the courses generally remain in their present occupation and often obtain advancement on account of work done at this school.

The board of administration of the school consists of the president of the chamber of commerce and three associates. The teaching personnel consists of a director, 7 instructors, 3 assistant instructors, and 3 foremen.

The attendance on January 1, 1899, was as follows:

ATTENDANCE IN EACH COURSE OF THE INDUSTRIAL SCHOOL OF TEXTILES, TOURCOING, JANUARY 1, 1899.

Courses.	Evening classes.	Day classes.
Spinning	41	9
Weaving	89	6
Mechanics	78	9
Commerce	48	4
Total	256	28

The number of graduates during the past five years is as follows:

GRADUATES OF THE INDUSTRIAL SCHOOL OF TEXTILES, TOURCOING, 1894-95 TO 1898-99.

Year.	Evening courses.	Day courses.
1894–95	70	8
1895–96	88	8
1896–97	89	9
1897–98	124	9
1898–99	132	12

The receipts and expenditures for 1898–99 were as follows:

Receipts:	
Contribution from the chamber of commerce	$714.10
Contributions from individuals	3,088.00
Tuition fees from the day courses	955.35
Tuition fees from the evening courses	104.22
Total	4,861.67
Expenditures:	
Salaries	2,702.00
Materials and other expenditures	1,447.50
Surplus from receipts	712.17
Total	4,861.67

GUTTENBERG TYPOGRAPHICAL SCHOOL, PARIS.

This school was founded in 1886 under the patronage of the Master Printers' Association. It is governed by a board composed of the executive officers of that organization. At first the pupils were recruited from among the apprentices of the various printing establishments, who came twice a week to attend the courses. This arrangement was inconvenient, and the association decided that the apprenticeship should be served entirely at the school and should last three years. To be received in this school boys must be at least 13 years of age and be provided with a certificate of primary education. The courses of instruction are free.

The instruction given is in two divisions: (1) Technical and practical: (2) supplemental instruction designed to improve the general education of the pupil, with particular reference to his trade.

The technical instruction comprises: (1) Ordinary typesetting; tables; job work; Greek characters and algebraic notation; paging and imposing; geometrical rule cutting; proof reading and correction. (2) Presswork in black and in colors. (3) Stereotyping; making the molds and setting the plates. (4) Electrotyping; its applications to typography. (5) Making of estimates; accounting and general management of a printing establishment.

The supplemental instruction comprises: (1) French language; (2) history and geography; (3) history of book manufacture and printing; (4) arithmetic, geometry, algebra; (5) elements of mechanics, physics, and chemistry applied to the typographic arts; geometrical and object drawing.

The time devoted to typographical work (composing and printing) is 37 hours per week; to stereotyping and mold making, 4; to supplementary instruction, 11; a total of 52 hours.

The school possesses a complete equipment of the most improved apparatus and materials for instruction, and the kind of training imparted to pupils is of a most practical and substantial character.

The attendance at this school on January 1, 1899, was 18 pupils, distributed over the three years' course provided by the curriculum. The courses are common to all, and are so arranged that during his attendance each pupil completes the whole series.

NATIONAL SCHOOL OF WATCHMAKING, BESANÇON.

The National School of Watchmaking, of Besançon, was founded in 1861 as a municipal institution. At first it was a day school intended for students living in the city. Shortly after a boarding department was added, in which students are boarded and lodged for a payment of 67.60 francs ($13.05) a month. These students, however, pay a tuition fee of 200 francs ($38.60) a year. In 1891 the school was made a State institution and consequently is now under the control of the ministry of commerce.

The purpose of this school is analogous to that at Cluses, hereafter described. Pupils must be at least 13 years of age and have completed their primary studies or equivalent instruction. Persons who are over 20 years of age and have exercised the trade of watchmaking are exempt from this examination.

The duration of study is 3 years. The theoretical instruction embraces the study of algebra to equations of the first degree, elements of plane geometry and plane trigonometry, elements of mechanics, the application of mechanics to watchmaking, drawing as applied to this trade, the elements of physics, chemistry, and cosmography, accounts, and the general principles of industrial economy. The practical instruction is given in the shops belonging to the school, and relates to all the operations of watchmaking and the general branches of fine mechanics or the making of instruments of precision. In the division of the time, 10 hours a week are given to theoretical, and 45 hours to practical workshop instruction.

In addition to the regular course there is a special department in which students who are recognized as being specially apt in their studies can receive more advanced instruction. In this department are given courses in mathematics, analytical geometry and differential and integral calculus, the application of higher mathematics to general mechanics, and especially to watchmaking, etc.

In 1900 the school had 55 students.

Concerning this school the Journal Officiel, in 1900, said: "No matter how satisfactory the results obtained by this school may be, it is generally agreed that its organization to-day no longer responds, either from the point of view of its programme of studies or from that of its administration, to the needs of an industrial region as important as that of Besançon and the Doubs department." A project for its reorganization is therefore now under consideration. It is proposed that the present courses shall be maintained, but that they shall be supplemented by (1) a shop in which all the operations of watchmaking can be performed, (2) a shop for the making of small metal objects or instruments of precision employed in the construction of watches and other articles, and (3) a shop for the making of electrical apparatus.

NATIONAL SCHOOL OF WATCHMAKING, CLUSES.

The national watchmaking school of Cluses is of especial interest from the standpoint of the study of the practical influences of a trade school upon the industry and locality for which it is created, for this school was founded for the especial purpose of aiding an industry which was rapidly declining.

At the end of the eighteenth century two-thirds of the population of this town was occupied in the watch and clock industry. In 1815, for various reasons, and especially on account of foreign competition,

a decline set in which continued during the next three decades. The municipality of Cluses, to revive the declining industry, demanded of the Sardinian Government the foundation of a special school of watchmaking.

The Government willingly acceded to this demand, and called in the director of the royal manufactory of Versailles, to prepare the plans for such an institution. These plans took the form of a proposal for a factory in which all the branches of watchmaking could be conducted, and of a school for the training of skilled artisans. Only the latter half of the proposition was adopted, and a royal school of watchmaking was authorized by decree of March 31, 1848.

The school opened in 1849 with 24 students, 12 boys and 12 girls. The pupils were divided into two classes. One class included pupils who desired to take a complete course in both the theory and practice of watchmaking, while the other included those who merely desired to serve an apprenticeship in a particular branch of the industry, and preferably one not then followed in the locality. Girls were admitted to the latter class only. The age of admission varied between 14 and 16 years. The knowledge required of pupils on entering was reading and writing for the second course, and reading, writing, and the four fundamental rules of arithmetic for the first. Candidates for the first course must also have commenced their apprenticeship in a watch factory.

During the years from the founding of the school to the annexation of Savoy to France, in 1860, the school continued its course, fully meeting expectations in its influence upon the restoration of the watchmaking industry in its locality. From 1848 to 1860, 295 students, among whom were a considerable number of persons distinguished in the trade, were trained. Of those so trained, 45, or about 15 per cent, were females.

In 1863 the Government ordered the assistant director of the Conservatory of Arts and Trades to make an examination of the school, with a view to determining what modification could be introduced with advantage into the school. It was especially desired to make its organization conform more to that of the schools of arts and trades. In accordance with his report, decrees were issued November 30 and December 7, 1863, reorganizing the school.

Girls were no longer admitted, entrance being restricted to boys over 12 years of age. Tuition became free. The duration of studies was fixed at two years, with a third year optional.

After being closed a short time for repairs, the school was reopened in 1864 with 18 students, of whom 4 were from departments of France other than upper Savoy. The school, in fact, was now a national institution. From this date the school has continued to advance in importance. The annual expenditure, which under the Sardinian Gov-

ernment had been 8,300 francs ($1,602), was increased, first to 20,000 ($3,860) and then to 25,000 francs ($4,825). In 1878 the number of students was 80, and the old buildings were entirely inadequate for the proper accommodation of that number. Plans for a new building, to be specially constructed so as to meet all requirements, were made. This new building was formally inaugurated June 21, 1886, and is a model edifice for its purpose.

It covers nearly 10,000 square feet of ground and has a very attractive architecture. On the ground floor are three large rooms used for recitations and drawing courses, and on the two upper floors four large shops, besides lavatories, dressing rooms, etc. The new quarters permitted an increase in the number of students until in 1900 it stood at 140, coming from 60 different departments.

In 1890 a new decree was issued, which determined the present organization and programme of the school. The purposes of the school were stated to be: (1) The formation of skillful and trained workmen capable of executing, in whole or in part, the apparatus destined for the measurement of time, or any other instruments of mechanical precision made use of in the sciences and arts; (2) to give to young men the instruction fitting them to become in these industries foremen or directors of establishments.

The school is administered by a director appointed by the minister of commerce, who has as assistants, instructors, shop foremen, and a council composed of the teaching staff and not more than four other members selected preferably from among the manufacturers of the district.

Admission is decided by the prefect of the department. A certain number of places are reserved for workmen who desire to perfect themselves in special branches of the watch-making trade. Such workmen can not remain more than six months in the school. Instruction is free, but the students must provide themselves with the tools required in the shopwork, books, etc. Whole or part scholarships for the payment of board and lodging are granted. More than 20,000 francs ($3,860) are expended annually for this purpose by the central Government, the department, and the commune. In 1899–1900, 105 students were receiving such assistance. The cost of board and lodging is about 600 francs ($116) a year, the administration of the school undertaking to find accommodations at this figure.

Pupils must be at least 14 years of age, and have received a certificate of primary studies, or give evidence that they have received equivalent instruction.

The duration of studies is three years. The theoretical studies embrace the French language, the elements of arithmetic, algebra, geometry and trigonometry, and mechanics, with special attention to electricity and drawing. The practical instruction is given in four

shops. In order to accommodate the students in the shops the school is organized in two divisions, but the apportionment of the time devoted to the different subjects is the same. Following is the programme for the first division. This relates to the winter months, or from November 3 to April 1. The programme for the remaining six months is slightly different, work beginning at 7 instead of 8 a. m. and ceasing at 6.30 instead of 7 p. m. The additional half hour is chiefly devoted to shopwork.

TIME SCHEDULE, WINTER TERM, NATIONAL SCHOOL OF WATCHMAKING, CLUSES.

Hours.	First year.	Second year.	Third year.
MONDAY, TUESDAY, WEDNESDAY, THURSDAY.			
8 to 9 a. m	Theory	Theory	Theory.
9 to 10 a. m	Shopwork	Shopwork	Shopwork.
10.10 to 10.15 a. m	Recreation	Recreation	Recreation.
10.15 a. m. to 12 m	Shopwork	Shopwork	Shopwork.
12 m. to 1.30 p. m	Lunch and recreation	Lunch and recreation	Lunch and recreation.
1.30 to 2.30 p. m	Theory	Theory	Theory.
2.30 to 3.30 p. m	Shopwork	Shopwork	Shopwork.
3.30 to 3.45 p. m	Recreation	Recreation	Recreation.
3.45 to 7 p. m	Shopwork	Shopwork	Shopwork.
FRIDAY.			
8 to 10 a. m	Drawing	Shopwork	Drawing.
10 to 10.15 a. m	Recreation	Recreation	Recreation.
10.15 a. m. to 12 m	Drawing	Shopwork	Drawing.
12 m. to 1.30 p. m	Lunch and recreation	Lunch and recreation	Lunch and recreation.
1.30 to 3.30 p. m	Shopwork	Drawing	Shopwork.
3.30 to 3.45 p. m	Recreation	Recreation	Recreation.
3.45 to 7 p. m	Shopwork	Drawing	Shopwork.
SATURDAY.			
8 to 10 a. m	Shopwork	Shopwork	Shopwork.
10 to 10.15 a. m	Recreation	Recreation	Recreation.
10.15 a. m. to 12 m	Shopwork	Shopwork	Shopwork.
12 m. to 1.30 p. m	Lunch and recreation	Lunch and recreation	Lunch and recreation.
1.30 to 3.30 p. m	Shopwork	Shopwork	Shopwork.
3.30 to 3.45 p. m	Recreation	Recreation	Recreation.
3.45 to 7 p. m	Shopwork	Shopwork	Shopwork.

An inspection of this statement of hours shows how large a part of the time of the students is devoted to shopwork.

Since 1886 the school has been in possession of a small shop for fine mechanical and electrical work, in which instruction is given by two special teachers. The courses of this department are attended by (1) young persons who have completed their studies in watch making and are desirous of making a further study of electricity as applied to watch and clock making, a branch of the trade which is becoming of greater importance, and (2) by young men who intend to enter the industry of the manufacture of instruments of precision, the construction of electrical apparatus, and, in particular, telephone and telegraph apparatus. The number of students in this section is constantly increasing. The school reports that these students on graduation find little difficulty in securing positions.

Since the annexation of Savoy to France, in 1860, this school has turned out 1,218 graduates. The following statement of occupations

of graduates will show that as far as information is obtainable the great majority have entered the trade in which they received instruction:

Teachers in various schools	8
Manufacturers or directors of establishments	46
Factory workers, watchmaking	121
Watch repairers	285
Watch dealers	418
Telegraph mechanics in State service	15
Mechanics in private establishments	33
Have abandoned watch trade from dislike of the work, lack of aptitude, or for other reasons	80
Deceased	131
Persons from whom no information was obtained (including 26 foreigners)	81

Commenting upon these figures, an official report of the school says: "The figures given above show that even considering the 81 persons from whom no information was obtained as lost to the trade, the proportion of those who have remained in the watch-making trade is over 85 per cent."

The present total expenditures of the school are 58,900 francs ($11,368), of which 56,900 francs ($10,982) are paid by the State and the remaining 2,000 francs ($386) by the Department of Upper Savoy.

TRADE SCHOOL OF WATCHMAKING, PARIS.

This school was founded in July, 1880. Its aim is to provide the clock and watch making industry in France with skilled workmen in all its specialties. It is a private institution, whose affairs are administered by a board which comprises a president, 2 vice-presidents, 2 secretaries, a treasurer, a librarian, and a directing committee.

The term opens September 1 and closes July 15. The programme covers 4 years and comprises practical and theoretical courses. The former are: First year, tools; second year, regulators; third year, chronometers; fourth year, simple and complicated watches, miscellaneous work. The time per week given to these courses is uniformly 48 hours. The theoretical instruction, occupying 8 hours a week throughout the 4 years, comprises: Geometrical drawing, drafting of tools, technical drawing in reference to watchmaking, arithmetic and geometry, elements of mechanics, technology, French language, elements of chemistry and physics, and theory of watchmaking.

The instruction is given by 4 teachers of practical work and 2 of theoretical branches. The school contains 4 workshops. A great quantity of apparatus and drawings is used in both the practical and the theoretical instruction. The library, museum, and collections are at the service of the pupils.

Each year, some weeks before the vacation, general examinations are held for the graduating class. The jury is composed of watchmakers and scientists. Diplomas are awarded to those who have

obtained satisfactory marks and have completed the practical and theoretical courses. In July prizes are awarded to the best pupils. A prize of 870 francs ($168) in specie (the Duprey legacy) is bestowed on the graduate making the highest average. Medals from the ministry of commerce, and tools, books, and instruments, are distributed.

The number of pupils on January 1, 1895, 1896, 1897, 1898, and 1899 was, respectively, 54, 52, 44, 45, and 44. The receipts and expenditures for 1899 were as follows:

RECEIPTS AND EXPENDITURES OF THE TRADE SCHOOL OF WATCHMAKING, PARIS, 1899.

Receipts.	Amount.	Expenditures.	Amount.
Subsidies from the State	$1,399.25	Pay of teachers	$3,565.10
Subsidies from the city of Paris	1,544.00	Rent, interest, cost of boarding department and scholarship pupils, repairs, supplies, and general expenses	7,141.00
Subsidies from trade associations	420.74		
Subsidies from individuals	166.95		
Tuition fees	3,556.99		
Scholarships:			
National	784.54		
Other	965.00		
Total	8,837.47	Total	10,706.10

GENERAL INDUSTRIAL SCHOOLS.

The reasons for classifying certain schools under this title have been fully explained, and a list of the schools so classified has been given. A few representative schools of this class are described in the following pages.

MARTIN SCHOOL FOR BOYS, LYON.

The institution for boys known as *l'École de la Martinière* was founded in 1833 with a legacy left to the city of Lyon by Major Martin, who wished to "establish an institution for the public welfare of this city." Its object is to prepare young men, not for any distinct trade, but for commercial and industrial careers in general, by giving them the advantages of a practical education, a habit of scientific reasoning, and, above all, by creating an enthusiasm for work.

The complete programme of instruction covers a period of four years and consists of a preparatory course of one year's duration and a three years' course in the work of the school proper. This work is divided into three general departments, viz, commerce and weaving, industrial chemistry, and civil engineering and electricity. During the first year all pupils pursue practically the same course of studies. Upon reaching the second year they are allowed to choose the particular course which they desire to enter and specialization begins, while in the third year the work is entirely specialized. Following is the programme of instruction and the hours per week devoted to each subject in the departments of industrial chemistry and civil engineering and electricity:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE DEPARTMENTS OF INDUSTRIAL CHEMISTRY AND CIVIL ENGINEERING AND ELECTRICITY IN THE MARTIN SCHOOL FOR BOYS, LYON.

Subjects.	Hours per week.				
				Third year.	
	Preparatory year.	First year.	Second year.	Civil engineering and electricity.	Industrial chemistry.
Preparatory lectures	2				
Penmanship	3	3	1		
Grammar	5	5	4		
History and geography	2	2	2		
Mathematics and mechanics	8	10½	8½	10	2
Physics and electricity		2	1	7	
Chemistry		2	6		27
Drawing	8½	8½	8½	10	3
Bookkeeping			2		
Elements of calculus	6½				
German language			3		9
Shopwork	1	3	6	11	
Industrial law				1	
Building construction				1	

The school possesses a very complete equipment of materials for instruction. Its affairs are administered by a board of seven members, named by the municipal council of Lyon and approved by the minister of commerce. The teaching personnel consists of a director, 36 instructors of scientific branches, and 10 master workmen for the shopwork.

The attendance on January 1, 1899, was as follows: Preparatory year, 171; first year, 154; second year, 127; third year, 83; making a total attendance of 535 pupils. The 83 pupils of the third year were apportioned among the departments as follows: Commerce and weaving, 20; industrial chemistry, 12; civil engineering and electricity, 51. The number of graduates in 1898 was 69.

SCHOOL OF FINE ARTS AND INDUSTRIAL SCIENCES, TOULOUSE.

The department of industrial sciences has existed in this school since 1857. In this department pupils are trained for positions as overseers of bridges and highways, and prospective candidates are prepared for the schools of arts and trades. The school also gives instruction to workmen in stonecutting and timberwork, and to artisans, such as machinists, electricians, plasterers, carpenters, masons, and joiners; it gives a knowledge that they can utilize in the prosecution of their trades. The operation of the school is controlled by a supervisory and improvement council, composed of persons best qualified for the position, and which is charged with the duty of introducing any needed improvements into the school.

The organization of the courses is as follows: The general course in industrial drawing (the oldest in the school) covers 3 years and consists of: (1) Interpretation of groups of solids with plane surfaces; (2) interpretation of groups of solids with curved surfaces; (3) drawing of machines. This course occupies 12 hours a week.

The theoretical and practical course in industrial drawing, which is distinct from the above course, is given in 2 divisions—elementary and superior—and covers 3 years. Lectures on theory are given at the same time to both divisions. This course in applied drawing occupies 10 hours a week.

The course in mechanics is taken by many pupils of the drawing courses. Its duration is, on an average, 2 years and 2 hours a week are devoted to it.

The course in stereotomy and descriptive geometry covers 2 years. First year, descriptive geometry, 2 hours a week; second year, descriptive geometry and stereotomy, 2 hours a week.

The course in physics consumes 2 hours a week; the course in chemistry 2 hours a week; the course in arithmetic 4 hours a week; in algebra, 2 hours a week; in elementary geometry and elevation drawing, 4 hours a week; in trigonometry, 2 hours a week.

In the chemistry class the pupils practice industrial processes, such as making soaps, wax candles, perfumes, drugs, etc. In physics the studies are specially directed toward industrial applications, as of electricity, optics, etc.

Many of the graduates secure employment in the industries of the region, or as road overseers, architects' clerks, and employees or subagents of the bridges and highways administration.

The institution receives a small subsidy from the State and a large one from the city of Toulouse. These are almost its entire revenues, tuition being free.

EASTERN TRADE SCHOOL, NANCY.

This school was founded in 1844, under the name "Loritz Trade School." In 1877 it was given a new impetus by the organization of a joint stock company with a capital of 750,000 francs ($144,750), which took charge of and definitely established it under its present name.

The object of this school is to prepare young men for admission to the schools of arts and trades, or other institutions of a higher industrial character, as well as to fit them for positions either in public or private enterprise in which a considerable degree of technical knowledge and skill is required. A certain number of young men complete their education at this school, and upon graduating secure employment in industrial establishments as foremen or skilled workmen, and sometimes as managers of workshops. They also receive sufficient commercial knowledge to enable them to work in offices as employees—salesmen or bookkeepers. The school is provided with very complete materials for instruction.

The regular programmes of instruction comprise a five years' industrial course and a three years' commercial course, the latter being subsidized by the ministry of commerce and industry. In addition there are special courses for pupils who wish to pursue certain lines

of work, and an elementary course for beginners. In the two regular courses the pupils follow the same studies during the first year, but beginning with the second year they are classified according to the occupation chosen by them, either industrial or commercial. In addition to these two parallel courses, special courses are given for the purpose of preparing pupils for the schools of arts and trades, for the higher commercial school of Nancy, and for the normal schools for teachers of industrial and commercial branches. A free apprenticeship course has been given since 1893.

The industrial instruction includes, among other things, decorative art work, industrial drawing for construction work, masonry, and carpentry; drafting boilers and machines, study of tools and machinery, practical mechanics, electricity; calculations and study of scales of prices; mathematics and industrial technology, physics and chemistry. The following table shows the hours per week devoted to each subject in the regular industrial course:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE INDUSTRIAL COURSE EASTERN TRADE SCHOOL, NANCY.

Subjects.	Hours per week.				
	First year.	Second year.	Third year.	Fourth year.	Fifth year.
Rhetoric and composition	12	12	11	6	.....
Mathematics and science	9	10	11	16	.....
Languages	3	4	4	4	.....
Drawing	4	4	7	8	12
Gymnastics	1	1	1	1	1
Applied science	.....	.....	.....	.....	10
Industrial bookkeeping and correspondence	.....	.....	.....	.....	3
Shopwork	.....	8	9	9	16

The government of the school is intrusted to a board of ten members selected from persons engaged in business and from among the faculty of the University of Nancy. A director has immediate supervision of the school. The entire teaching personnel comprises 40 instructors. On January 1, 1899, 126 pupils were attending the commercial courses, 177 the industrial courses, and 112 the special courses.

The number of graduates of this school during the past five years and the character of employment they engaged in is as follows:

NUMBER AND PRESENT EMPLOYMENT OF GRADUATES OF THE EASTERN TRADE SCHOOL NANCY, 1893-94 TO 1897-98.

Year.	Total graduates.	Graduates employed in—		
		Industrial occupations.	Commercial occupations.	Various other occupations.
1893-94	55	16	29	10
1894-95	66	22	31	13
1895-96	65	28	29	8
1896-97	76	34	33	9
1897-98	69	35	25	9

The total expenditures of the school for 1899 were 195,815 francs ($37,792). The receipts for the year included 1,500 francs ($290) from the ministry of commerce, 3,375 francs ($651) from the State, 1,125 francs ($217) from the department, 169,161 francs ($32,648) from tuition fees, and 16,160 francs ($3,119) from other sources, leaving a deficit of 4,494 francs ($867) to be supplied by the stock company.

TRADE SCHOOL OF THE NORTHERN RAILWAY COMPANY, PARIS.

This school is annexed to the machine shop of Paris la Chapelle, belonging to the company. Its object is to furnish sons of employees of the company, who alone are admitted to it, a thorough technical training and to make of them skilled and well-informed workmen. Upon graduating the apprentices can either enter the railway service or engage in private industry.

The school is placed under the supervision of the administrative council of the company, and is superintended more directly by the engineer in charge of supplies and rolling stock, the chief engineer of the machine shops, and the superintendent of the train personnel.

In general, candidates for admission must be over 13 and under 15 years of age, but boys of 12 may present themselves for the entrance examination, provided they hold a certificate of primary education and a certificate of physical qualifications. This examination is taken in the presence of the instructors and a delegate from the directing committee of the railway company. It consists of: Written tests comprising an ordinary dictation for orthography and problems in arithmetic, including the metric system; an oral examination in geography, history, grammar, arithmetic, the metric system, and elementary geometry.

The course of study covers three years, the school year beginning in the middle of September and closing at the end of August. The morning hours from 7 to 11 o'clock are devoted to theoretical instruction; the afternoons from 12 to 5 o'clock to shopwork. The evenings are spent in reviewing the theoretical work of the day or doing exercises based upon it.

The theoretical work is apportioned as follows:

HOURS PER WEEK DEVOTED TO THEORETICAL WORK, TRADE SCHOOL OF THE NORTHERN RAILWAY COMPANY, PARIS.

Subjects.	Hours per week.		
	First year.	Second year.	Third year.
French language	6	2	.....
Geography	2	2	.....
Arithmetic	6	2	.....
Geometry	4	4	4
Physics	.....	2	2
Algebra	.....	.....	4
Mechanics	.....	.....	2
Chemistry	.....	.....	2
Technology	.....	.....	4
Drawing	6	6	12

The programme of practical instruction comprises two main divisions. The elementary division covers the following ten operations, and in the order named: (1) Dressing with the file a parallelopiped having a square base; (2) executing with the file two rules of the same length, width, and thickness; (3) executing a parallelopiped having an octagonal base from one having a square base by cutting the edges with a graver; (4) turning with the hand tenter for ten days, to learn to execute a cylinder; (5) transforming the cylinder into a parallelopiped having a hexagonal base; (6) making tenons and mortises of 10 millimeters (0.39 inch) diameter; (7) making tenons and mortises of 4 millimeters (0.157 inch) diameter, with chamfers and olive moldings at the edges; (8) work with compass; (9) work with calipers; (10) work with the sector compass.

The other division, comprehending the intermediate and higher operations, covers exercises and work executed with the following 8 kinds of tools: Hand vise, wrench with central gap, wrench with two gaps, ratchet stock, squares, draw plates, pump puppet, machine lathe.

The second year ends with blacksmithing operations—striking, managing the fire, heating over and forging the gravers, drills, and other tools. The pupils are likewise instructed in tempering and annealing. They are required to execute on the lathe the pieces needed for the exercises above mentioned. Those who are to make a specialty of turning execute the following lathe work: Pointed axle washers, articulation rings and axles, screws for machine lathes and other machine tools, brake screws and nuts, switch screws and nuts.

Theoretical instruction is given by three teachers—one for each year's course—and a teacher of drawing. The shopwork is directed by a fitter, a turner, and a blacksmith, under the supervision of the foreman of each shop and of the engineer in chief.

At the close of each term the railway company distributes among the pupils in each division who have done good work and behaved well, money prizes, the size of which is based on the recipient's efforts and progress. In the year 1897–98 the highest prize was 130 francs ($25.09), the lowest, 28 francs ($5.40), and the aggregate sum received by all the pupils was 1,800 francs ($347). Certificates are awarded those who pass the graduating examinations.

The graduates who have obtained the highest marks and shown the greatest aptitude are taken into the company's shops as regular employees. Thus the vacant places are filled in the order of merit of the candidates. Those who can not be given employment at once are admitted in preference to outsiders as vacancies occur. At the start the minimum wage received by graduates is 2.25 francs ($0.43) a day; as they gain experience in their work mounters receive an average daily wage of 2.65 francs ($0.51); fitters, 4 francs ($0.77); and turners, 2.90 francs ($0.56). Further increases are made at the rate of 25 centimes (5 cents) a day, according to the dexterity and capability of the workman. The graduates of the school are under no obligation to enter the service of the company, but are entirely free to take employment in private industrial establishments if they find better situations than the company could make for them.

The number of pupils attending this school on January 1, 1899, was 45. The cost of maintaining this school amounts to about 11,000 francs ($2,123) annually, and is borne entirely by the railway company.

THE J. B. DE LA SALLE SCHOOL, REIMS.

This school was established by the Brothers of Christian Schools (*Frères des Écoles chrétiennes*) in 1895, with the cooperation of a number of manufacturers and merchants of the city. Its primary aim was limited to the training of intelligent workmen, capable of becoming foremen after longer or shorter terms of shop service. Under a reorganization recently perfected, the school comprises two distinct departments: (1) A preparatory department to which the pupil is admitted at 13 years of age, if he possesses the degree of education required to obtain the certificate of primary studies. (2) A technical department of arts and trades. Admission to the latter department is determined by competitive examination, but candidates for entrance must be not less than 15 nor more than 17 years of age.

In each department the technical instruction is directed by an engineer who is responsible to a commission composed of manufacturers and engineers. The instruction is classified in each department under three heads: Religious, theoretical, and practical. The superior department is known as the "trade school of arts and trades." Students from other schools are admitted to the competitive examinations by which entrance into this school is obtained.

In the preparatory department the programme of theoretical studies corresponds to that used in the advanced primary public schools. Practical instruction is given in shops for fitting, joinery, modeling, carving, and weaving. During the first year 7 to 8 hours a day are devoted to class work, and but 2 to 2½ hours to shopwork. This is in reality a trial year, during which the theoretical studies are pushed rapidly, while the trade inclinations of the pupils are tested in the various shops. During the second year 4 to 5 hours a day are spent in shopwork. At the end of this year the student will either enter the competitive examination for admission to the newly created superior department or school, or, if he should not desire or has not the ability to enter that examination, he may conclude his trade-school training by remaining another year in the preparatory department. The instruction during the extra year includes industrial drawing, technology, practical applications of mathematics, and a continuation of the shopwork. The student, thus prepared, may become an intelligent and skillful workman. The number of students in the preparatory department in 1899 was 75. At present the institution admits boarding pupils, part boarders, and day pupils to the preparatory courses. In 1899 about half of those enrolled were day pupils; the rest were boarding pupils, at 600 francs ($116) a year, and part boarders, at 300 francs ($57.90) a year.

The superior department, or the "school of arts and trades," was not opened until October, 1900. In this department the theoretical instruction embraces advanced algebra, plane trigonometry, elemen

tary principles of analytical geometry, descriptive geometry (drawings to be shaded and the dimensions written in), the elements of perspective and stereotomy, kinematics, mechanics (pure and applied), physics and chemistry with their industrial applications, industrial drawing and technology, the French language, history, geography, bookkeeping, and industrial economy.

It is the intention to give the students a practical training in special workshops for machine fitting, joinery and pattern making, founding, blacksmithing, and coppersmithing, but in 1900 equipment had been provided only for the shops pertaining to the preparatory courses. The intention then was for both departments to make use of those shops until the special equipment for the superior department could be provided.

The conditions of admission to this advanced department are analogous to those for the national schools of arts and trades. The curriculum covers 3 years. None but boarding pupils are admitted. The charges are 700 francs ($135) a year.

MIXED TRADE AND PREPARATORY SCHOOL, RIVE DE GIER.

In 1894 a technical division was added to the primary school directed by the Brothers of Christian Schools (*Frères des Écoles chrétiennes*) at Rive de Gier. Those students who successfully terminate the primary studies at this school are allowed to enter the technical division, in which the courses are of three years' duration. The object of the instruction in this division is, first, to prepare some of the students for entrance into the national schools of arts and trades, and secondly, to give the others at least a partial industrial education. During the first and second years the studies are the same for both classes, the principal object being to give the students a thorough superior primary education. Only four hours per week during the first and seven hours per week during the second year are allowed for shopwork.

At the end of the second year the students are examined as to their fitness to receive the certificate of the superior primary studies. Those who are successful are placed in a special class to prepare for the national schools of arts and trades, while those who fail to obtain the certificate pass the third year in a "section for apprentices." For these latter students the shopwork is very much extended. With the exception of three hours, two of which are devoted to drawing and one to spelling, arithmetic, and religious instruction, all the day is spent in practical work. For this three shops are provided—one for fitting, one for joinery, and one for blacksmithing. The shop for machine fitting is more completely equipped than the others.

While the blacksmithing and joinery shops are provided with all the necessary tools, they are not intended to receive as many students as the fitting shop. Those students who pass the third year in the

"section for apprentices" are awarded a "workman's diploma" upon passing a satisfactory examination at the end of the course.

In 1899 the number of pupils attending the school was 77. Of these, 38 were in the first year, 25 in the second year, and 14 in the third year classes.

As showing the satisfactory character of the instruction received, it is stated that of the 9 pupils who took the entrance examinations of the national schools of arts and trades, at the end of the school year 1898–99, 8 were admitted. Of 8 pupils in the apprentice section, 7 obtained the "workman's diploma" and at once secured places in manufactories of the neighborhood.

The tuition is free.

TRADE AND TECHNICAL CONTINUATION SCHOOLS AND COURSES.

These institutions have been considered at some length and their principal characteristics noted. They represent the chief form which the efforts in the direction of providing for the trade and technical education of persons already employed have taken.

A number of schools and courses are described in the following pages. These institutions do not by any means fully represent the class to which they belong, but have been introduced merely by way of illustration. An idea of the large number of trades and the variety of industries to which the instruction in this group of institutions relates may be obtained by referring to the list on pages 733 to 736.

The descriptions of schools and courses belonging to this group are followed by two or three short articles in regard to the work of particular associations in the direction of trade and technical education.

Institutions in which the programmes include both theoretical instruction and practical work are first described.

TRADE SCHOOL FOR HAIR DRESSING, LYON.

This school was founded in 1890 by the Journeymen Hair-Dressers' Union. The instruction is essentially practical, and is given on living models. The following subjects are included: Headdresses of ladies of different epochs, men's headdress, curling and puffing, false hair, management of a barber shop, and hygiene of the headdress. The course begins October 1 and closes January 15.

The attendance on January 1 of the past five years was as follows: 1895, 9; 1896, 110; 1897, 95; 1898, 125; 1899, 120. The receipts of the school for 1899 were 150 francs ($28.95) from the State, 300 francs ($57.90) from the city of Lyon, 590 francs ($114) from the Hair-Dressers' Union, and 163.75 francs ($31.60) from various other sources.

SCHOOLS OF CARPENTRY MAINTAINED BY EMPLOYERS' ASSOCIATION, PARIS.

These schools, two in number, were established in October, 1893, with the object of giving a technical training, both theoretical and practical, to apprentices and workmen. Instruction is gratuitous, and is restricted to pupils of French nationality who are over 14 years of age. Each school is governed by a separate director, who is also a master carpenter. The courses begin on October 25 and end February 28. Linear trade drawing is taught in lessons of 2 hours each on four days of the week. This instruction comprises: (1) Working drawings on paper of square pavilions, slants, fore parts of buildings (*arrat-corps*), mansard roofing, St. Andrew's crosses, trestles, gutters, different forms of vaulting, etc.; (2) sections of parts of buildings, and the fitting of the pieces drawn and studied. On one day of each week two hours are devoted to geometry, mensuration, and practice in carpentry work.

The total attendance upon the two schools for the year 1898 was 110. The total receipts of the schools for 1899 were 2,542 francs ($491), of which 200 francs ($39) were received as a subsidy from the chamber of commerce, 852 francs ($164) from the employers' association, and the balance, 1,490 francs ($288) from individual members.

TRADE COURSES FOR CARRIAGE MAKERS, PARIS.

The Wagon Makers' Union of the Department of the Seine founded, in 1881, trade courses for apprentices and young workingmen desiring to improve their knowledge of carriage building. An additional school of the same class was opened in 1891 at the request of workingmen of the twelfth arrondissement; in 1893 a third was founded in the fifteenth arrondissement; in 1898 new schools were founded at Clichy and Saint Denis, making 5 schools having identical courses in Paris and its suburbs.

The courses begin October 1 and close at the end of March. They are held from 8 to 10 p. m. on Tuesdays, Wednesdays, Thursdays, Fridays, and Saturdays of each week. Workingmen taking these courses pay a fee of 2 francs ($0.39) a month.

The instruction comprises two divisions: Joinery, or the construction of the bodies of carriages, and mounting, which includes the assembling and fitting of the different parts constituting the running gear, etc. The instruction comprises oral lessons, practical exercises, and drawing and outlining. On January 1, 1899, there were 146 men attending these courses.

The receipts for 1899 consisted of subsidies from the State, 1,000 francs ($193); from the city of Paris, 4,500 francs ($869); from the Wagon Makers' Union, 1,369 francs ($264), and tuition fees, 165 francs ($32); making a total of 7,034 francs ($1,358.)

TRADE COURSES FOR CHIMNEY BUILDERS AND REPAIRERS, ETC., PARIS.

These courses were established in November, 1886, by the Journeymen Chimney-Builders' Union for the purpose of bettering the condition of workmen of this body, by giving them the necessary technical knowledge and practice.

The theoretical course consumes two hours on Friday of each week, and includes general calculations required in installation of heating apparatus, determining the amount of heat absorbed by the walls, calculating the dimensions of a hot-air furnace, the heating surface, the consumption of fuel, the surface of the fire grate; calculations concerning intersections, flues, air inlets, horizontal and vertical heat and smoke pipes, temperature and velocity of the hot air on leaving the pipes; equivalence of surfaces of different forms, principles of construction, resisting power of the iron parts, etc.

The practical course comprises construction of chimneys and stoves in faïence ware, furnace construction, ceramic linings; installation of the heater of the Michel Perret system; and brickwork. Instruction in free-hand and geometrical drawing is also included. These courses are taken, on an average, by 40 pupils.

The receipts for 1899 included a subsidy of 1,000 francs ($193) from the commune. Expenditures were 3,183 francs ($614). The balance of the money necessary to meet the total expenditures was derived from trade unions.

TRADE COURSES OF THE UNION OF JOURNEYMEN HOUSESMITHS, ETC., PARIS.

This union was formed in 1873, and its courses of technical instruction date from 1880. At first it instituted practical courses in blacksmithing and fitting, with the view of improving workmen in the locksmith's art and giving apprentices and young workmen a better knowledge of their craft. In 1882 a drawing course applied to locksmithing (plans, sketches, diagrams, etc.), was added, and, in 1896, a course in repoussé and relief work with the mallet (artistic leaf work of the French and Hungarian schools). The latter course is designed to preserve the housesmith's art, as it appears in the styles of the period of Louis XV, Louis XVI, and Jean Lamour, at the same time introducing the improvements made possible by progress in the methods and means of execution.

These courses are followed assiduously by many pupils who desire to acquire the practice in the housesmith's art which the metal-working factories, with their machine processes and division of labor, tend to abolish. The courses open October 1 and close the beginning of August. The full programme comprises everything in the line of locksmithing, blacksmithing, fitting, job work, bell hanging and tele-

phone installation, artistic housesmithing, relief work with the mallet, leaf work, and the drawing of plans and diagrams.

The attendance on January 1, 1899, was 72 pupils. The only receipts shown in the budget for that year consist of the subsidy of 1,000 francs ($193) from the city of Paris. The total expenditures for the year were 2,111 francs ($407).

TRADE SCHOOL FOR DRAWING AND MODELING OF THE UNION OF JEWELERS, GOLDSMITHS, ETC., PARIS.

After the expositions of 1855, at Paris, and 1862, at London, the jewelers and goldsmiths' guilds, saw the need of a drawing school for workmen and apprentices. Nothing of the sort, except two evening drawing schools, existed at that time. To meet this need this school was established in 1867.

The courses are opened in October and closed at the end of the following July. The curriculum covers four years, and in addition to the regular work it provides for annual competitions in drawing, which are open to the workmen of the entire country, annual competitions in technical execution among apprentices and workmen, and technical trade lectures.

Following are the subjects taught, with the number of hours per week devoted to each:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE TRADE SCHOOL FOR DRAWING AND MODELING OF THE UNION OF JEWELERS, GOLDSMITHS, ETC., PARIS.

Subjects.	Hours per week.			
	First year.	Second year.	Third year.	Fourth year.
Elements of geometry, linear drawing, elements of architecture	4	4	.....	.....
Linear composition, history of styles, relief drawing	6	6	4	.....
Composition	.....	.....	6	10
Sculpturing and designing	.....	.....	.....	10
Bas-relief work	.....	.....	.....	10

The composition work includes copying from past styles and from plant forms.

Courses in chasing and enameling occupy 4 hours a month each. Two hours a month each are devoted to industrial application, metallography, practice in metallurgy, founding, and patent law. Ten teachers are employed in the various departments of the school.

The school is equipped with drawing apparatus, screens, a dark room, a mineralogical collection, drawings representative of different periods, articles in gold and silver made in the technical competitions, an art and technical library, plaster casts and other models, a furnace for enameling, lathes, rollers, wire-drawing benches, engraving machines, etc., and workrooms for jewelers, goldsmiths, chasers, and engravers.

The number of pupils in attendance on these courses on the 1st of January, 1899, was 157.

The school receives subsidies from the State, the city of Paris, and various associations. In 1899 the amount received from the State was 3,500 francs ($676), and from the city 5,000 francs ($965). The total receipts for the year were 18,586 francs ($3,587), including 1,886 francs ($364) received in tuition fees. The expenditures were 22,524 francs ($4,347), leaving a deficit of 3,938 francs ($760).

While its work is under no direct State authority, some of the pupils of this institution have as artisans been excused from military service. Its governing board consists of the director, the president of the trade union (*chambre syndicale*), and the president of the improvement committee.

SCHOOL OF DESIGN FOR IMITATION-JEWELRY MANUFACTURE AND ALLIED INDUSTRIES.

The school of design for imitation jewelry was founded in 1873 for the purpose of raising the artistic level of this distinctively Parisian industry. The school occupied different locations successively until 1887, when the city, in view of the service rendered, fitted up rooms for it in a primary school in the Rue Chapon. One room is devoted to instruction in drawing generally, one to drawing from plaster casts, and a third to shopwork.

The courses begin September 20 and close July 15. Each course covers a period of 4 years. The instruction comprises drawing from plaster casts, modeling, study of geometrical principles as applied to jewelry work, study of the flower and composition, study of styles, and practical courses in goldsmithing and engraving.

The attendance on January 1 of each year from 1895 to 1899 was as follows: 1895, 162; 1896, 189; 1897, 177; 1898, 181; 1899, 187.

The school is supported by subsidies from the State, from the city of Paris, from individuals, and from the association of jewelers. In 1899 the receipts from the State were 2,500 francs ($483); from the city, 5,500 francs ($1,062); from individuals, 4,121 francs ($795), and from the association of jewelers, 1,245 francs ($240)—a total of 13,366 francs ($2,580). This last amount also represents the cost of maintenance of the institution for the year.

TRADE SCHOOL FOR JOINERS, PARIS.

This school was founded in 1885 and was formally opened May 1, 1886, under the name of "Trade courses in drawing and modeling for building joiners of the Department of the Seine." It is conducted by an independent group, belonging to no union, the council of which, on January 1, 1896, changed the name to "Trade School of Joinery."

The courses, which are free, are organized in a practical way. Each pupil is handled according to his ability and aptitude, and led method-

ically to the completion of his work. A uniform plan of instruction is rendered impossible on account of the absence of pupils sometimes for a week, a fortnight, or even a month at a time. The courses begin September 1 and close July 15. They are divided into three sections or grades, each requiring a year's work and consuming 6 hours per week.

The first year is given to an elementary and intermediate course, comprising introductory principles, definition of geometrical figures, demonstration of solids, plane geometry, geometrical figures, ordinary curves, etc.

The second year, or superior course, comprises descriptive geometry and its direct application to joinery, study of staircases and of arches, architectural principles applied to joinery, complete study of working plans, wood modeling.

The third year's work consists of the practical application of principles learned during the second year in construction work and in the execution of models.

On January 1, 1899, 62 pupils were attending the school.

The total receipts for the year 1898–99 were 4,208 francs ($812), of which amount 500 francs ($96.50) was received as subsidy from the State and 3,500 francs ($676) from the department.

TRADE SCHOOL OF THE PAPER AND PAPER GOODS MAKERS' ASSOCIATION, PARIS.

This institution was founded in 1868 for the instruction of apprentices and young workers in both commercial and industrial pursuits in the paper and paper-goods industries. It is managed by a committee consisting of representatives of the union and of the subscribers and donors. Its objects are: (1) "To encourage among apprentices and other young employees of both sexes a fondness for work, application, and good behavior in the factory, the store, and the home; (2) to raise the level of trade knowledge while completing the general education; (3) to arouse emulation and develop manual skill in order to train apprentices to become high-class workers."

The school is in session on Mondays, Tuesdays, Wednesdays, and Thursdays from 8 to 10 p. m., and on Sundays from 8.30 to 11.30 a. m., from October 1 to April 30. No tuition fee is charged.

The entire course covers 4 years. Instruction is given in the general primary branches, trade subjects generally, and in special technical work for apprentices.

The first comprises arithmetic, accounting, commercial correspondence, and French language and composition.

Under general trade subjects are included the history of the paper industry and the part played by France in its development, the sources of raw material, the centers of production, the qualities of foreign

products, and the leading commercial routes; a study of raw materials, chemical processes involved in the manufacture of paper, and of machines used; also industrial drawing, embracing geometrical, perspective, linear, and decorative drawing, and special geometrical drawing applied to the manufacture of pasteboard goods.

The special apprenticeship instruction includes theoretical and practical work in blank-book manufacturing, ruling, and manufacturing various kinds of pasteboard goods. The last subject does not merely include such work as is executed in shops, but the pupils, who are mostly girls, also learn tracing, cutting out, and putting together all sorts of pasteboard work.

The hours per week devoted to each study are as follows: History, geography, and French, 1; general trade studies, 1; industrial drawing, 2; special geometrical drawing, 1½; blank-book manufacturing, 2; cardboard goods manufacturing, 1½; cutting, ruling, folding, etc., of blank books, 2½.

At the close of each school year awards are distributed among the pupils for meritorious work. These consist of savings-bank accounts, memberships in the retirement fund, silver and bronze medals, books, etc.

The school has four rooms. One of these is devoted to technical and theoretical instruction and industrial drawing; another is used for theoretical and practical work, paper cutting, sewing blank books, numbering, folding, etc.; the third is devoted to the theoretical and practical work of blank-book and pasteboard-goods manufacturing, and the fourth is used for the class in special geometrical drawing.

The school is well equipped with machinery, tools and materials used in the paper-goods industries, collections of paper products and samples of raw materials, various kinds of paper, books, etc.

The attendance on January 1 of each year of the five-year period ending 1899 was as follows: 1895, 175; 1896, 158; 1897, 181; 1898, 172; 1899, 162.

The following statement shows the receipts and expenditures of this school during the school term 1898–99:

Receipts:	
Subsidies—	
From the State	$694.80
From the department	193.00
From the city of Paris	579.00
From the chamber of commerce	48.25
From trade unions	250.90
From individuals	1,691.17
	3,457.12
Deficit made up by members of the administrative committee	172.96
Total	3,630.08

Expenditures:	
Salaries of professors and assistants	$694.80
Salaries of secretary and overseers	270.20
Materials and supplies	392.98
Rewards to pupils	1,058.13
Expenses of stated functions, exhibitions, excursions, etc	629.46
Other expenditures	584.51
Total	3,630.08

COURSES IN PATTERN DESIGNING, ETC., FOR BAR-LOOM PASSEMENTERIE WORK, PARIS.

These courses are maintained by the Association of Bar-Loom Passementerie Designers, which was founded April 7, 1889, for the purpose of representing and defending the general interests of the trade, of guaranteeing a supply of samples, of providing apprentices with the necessary instruction in their trade, and of furnishing the country with skillful and educated workmen. Trade courses are given during the period from October 15 to the end of May. A course is completed in 10 weeks.

The programme of instruction includes: Analysis of fabrics of all kinds and placing of designs on cards; composition of new patterns; pricking designs on cards; study of raw materials used in passementerie manufacture; study of fashions in ladies' wear; furniture trimmings; bar-loom and handloom working; high warps; low warps. Instruction in these various courses is given, in part without remuneration, by 4 teachers.

About 35 pupils were in regular attendance in 1899.

Small subsidies are received from the State and from the city of Paris. The total expenditures in 1899 were 1,964 francs ($379). The total receipts were 1,070 francs ($206), leaving a deficit of 894 francs ($173).

TRADE SCHOOL OF THE UNION OF BAR-LOOM PASSEMENTERIE WEAVERS, PARIS.

In 1881 this trade body organized courses for the general instruction of young apprentices in the trade, and particularly to inform them respecting certain changes and improvements to be introduced into the art of passementerie weaving.

These courses extend from October 15 to June 15. The programme embraces three divisions of instruction, viz: Fabric designing and pattern making; demonstrations on the loom; demonstrations in the manufacture of chenille. The duration of the course in each of these three divisions is 4 years. Instruction occupies 8 hours per week, and is given by a teacher of fabric designing, and one each of silk and of woolen passementerie weaving.

The equipment for instruction consists of 1 Jacquard loom, 1 high-warp handloom, 1 bar loom for plain weaving, 1 handloom for demonstration, 1 chenille machine. The institution possesses a technical library and a collection of patterns and designs. A collection of samples produced by members of the union may be mentioned as a part of the teaching material.

The total attendance on January 1, 1899, was 24. Attendance during the four previous years was from 15 to 20.

The expenditures for 1899 amounted to 2,446 francs ($472), of which 1,126 francs ($217) went for salaries and 500 francs ($96.50) for rent. The receipts for the same year were 2,480 francs ($478.64), comprising subsidies of 500 francs ($96.50) from the State, 1,500 francs ($289.50) from the city of Paris, and 480 francs ($92.64) from membership payments.

COURSES IN ROOFING, PLUMBING, GAS FITTING, ETC., PARIS.

This school was opened April 22, 1887, and is maintained by the association of master roofers, plumbers, etc., of Paris. Its purpose is to provide gratuitous continuation courses for young workmen and employees of this trade body, and to furnish them information they can not acquire in the work yards. In 1891 a special course in mensuration was added. The school buildings comprise a secretary's office, three lecture halls, and a large workshop. The courses begin on October 25 and end on March 25 of the following year.

The programme of practical instruction comprises all that relates to the operations of roofing, plumbing, gas fitting, sanitation work, etc. This work occupies 2 hours per week. The theoretical instruction includes a complete course in roofing and plumbing mensuration and occupies 1½ hours per week. Special lectures are also given on roofing in general, hot-water circulation, electricity, industrial metals and acids, and geometrical drawings. From two to six lectures are given on each of the following subjects during the year: Hygiene, sanitation, gas, chemistry, physics and electricity, plumbing, spigot work, and geometry.

The school has a full equipment of all the various tools and supplies used in roofing and plumbing work. At the close of each school year an examination, in which all the pupils of the school participate, is held before a committee from the association. In this examination pupils receive credit for work executed during the year. Every two years prizes of books and of money, provided by members of the association, are awarded to the most deserving pupils.

On January 1 of the years 1897, 1898, and 1899, there were, respectively, 108, 132, and 124 pupils attending these courses.

The total receipts for 1899 was 6,421 francs ($1,239), including a subsidy of 1,000 francs ($193) from the State and 200 francs ($38.60)

from the chamber of commerce. The total expenditures were 6,421 francs ($1,239), of which 2,011 francs ($388) went for salaries, and 1,227 francs ($237) for rewards to the pupils.

SCHOOL FOR MINE BOSSES, SAINT-ETIENNE.

This school was opened November 15, 1892. It is a private continuation school, founded and maintained by an organization of coal operators known as the *Comité des Houillères de la Loire*. Its aim is to train pupils for positions as mine bosses and overseers in the employ of the various coal-mining companies of the Loire basin.

The affairs of the school are administered by a directing committee chosen annually by the *Comité des Houillères* from among its membership, and which consists of the president and two members of that organization, and the director of the State School of Mines of Saint-Etienne.

The programme of instruction comprises two main divisions, viz, mining operations and general education. In the former the theoretical instruction is somewhat more elementary than that given in the schools for mine bosses, etc., at Alais and Douai. The practical experience is acquired in the mines, the pupils taking their places as workmen and changing work at certain periods. This instruction is supplemented by visits to mines made under the guidance of an instructor.

The general course of instruction is of an elementary and practical character, comprising arithmetic, geometry, elements of mine engineering, mechanics, physics, chemistry, care of the injured, hygiene, and a detailed study of the laws, decrees, and regulations pertaining to mines. The curriculum covers only one year, but under special circumstances pupils may repeat their year's studies. The course in mining operations occupies 9 hours a week, and in the general course the six studies—arithmetic, geometry, mechanics, plan drawing, physics, and chemistry —together consume 9 hours a week. The equipment includes a chemical laboratory and models for teaching the mining operations. Diplomas are awarded the pupils who on completing their studies have attained the required proficiency.

The number of pupils in attendance in 1899 was about 14. The following table gives the attendance, average age of pupils, and diplomas awarded during the period 1892–93 to 1896–97.

NUMBER AND AVERAGE AGE OF PUPILS AND DIPLOMAS AWARDED AT SCHOOL FOR MINE BOSSES, SAINT-ETIENNE, 1892–1893 TO 1896–1897.

Items.	School years.				
	1892–93.	1893–94.	1894–95.	1895–96.	1896–97.
Number of pupils	20	17	17	16	15
Average age of pupils	29	31	28	26	27
Number of diplomas awarded	8	10	14	11	13

Eleven graduates of this school occupy places as mine bosses (*gouverneurs*), 39 as under-bosses or gang foremen, and 5 as fire-damp inspectors in the mines of the Loire basin. The entire cost of maintaining the school is borne by the organization which founded it.

The continuation schools next considered are those in which the instruction is purely theoretical or technical.

APPRENTICESHIP SCHOOL OF THE INDUSTRIAL SOCIETY, NANTES.

The Industrial Society of Nantes is composed of persons of various trades organized for the purpose of educating apprentices. The school is open to all young persons whose occupations require special and technical knowledge.

The school is in session two hours every morning so that apprentices may attend before their regular working hours. The practical work is all done in the shops where the apprentices are employed.

The studies are both technical and general. The subjects taught are free-hand, linear, and ornamental drawing, French language, arithmetic, algebra, geometry, descriptive geometry, bookkeeping, physics and chemistry, and mechanics.

The society possesses a library of several hundred volumes relating to industrial and economic subjects, apparatus for physical and chemical demonstrations, and a collection of designs and models for the use of the pupils.

Pecuniary rewards are given to pupils whose work and conduct have been satisfactory, and at the end of the third year medals are distributed for practical work executed in the shops where they are apprenticed. Upon graduating, pupils whose work during the several years has been satisfactory receive diplomas. Medals and prizes are given by the associations of master builders and mechanics. Two prizes, each consisting of a bank account of 150 francs ($28.95), are given from a fund founded by a master locksmith, who was formerly a pupil of this school.

In 1899 there were 115 pupils in attendance at the school.

The following statement shows the receipts and expenditures of the society for the year 1899:

Receipts:	
Contributions—	
From the State	$193.00
From the department	289.50
From the city	482.50
From the chamber of commerce	193.00
From trade unions	19.30
From private individuals	358.98
Various receipts	93.16

Receipts—Concluded.	
Revenues of the society	$829.73
Donations	289.50
Total	2,748.67
Expenditures:	
Teachers' salaries	699.54
Administrative personnel (miscellaneous expenses)	46.32
Rewards and stipends to pupils	1,053.24
Books and furniture	196.21
Heat and light	91.83
Contribution to the mutal relief fund	96.50
Repairs	167.81
Taxes and insurance	88.84
Prizes, library	190.82
Surplus	117.56
Total	2,748.67

SCHOOL FOR CABINETMAKING MAINTAINED BY THE ASSOCIATION FOR THE PROTECTION OF APPRENTICES, PARIS.

In 1867 this association, known as the "*Patronage industriel des enfants de l'ébénisterie*," organized manual competitions intended for the instruction and improvement of apprentice marquetry workers, block cutters, turners, wood carvers, chair joiners, and cabinetmakers. These competitions have been continued every year since. In 1873 a drawing school was established in which the instruction given relates specially to the furniture-making industries.

The present aim of the association is to give to the apprentices a theoretical training which they do not obtain in the shops; to further the progress of the industry by creating, through manual competitions, a rivalry among apprentices and young workmen, and also to stimulate designers, through competitions, to the development of new ideas in decoration, by means of exhibitions of the works executed in these competitions and of works of art in decorative furniture, such as carved work, inlaid work, trimmings, artistic ironwork, etc. It also seeks to put workmen and artists in pattern drawing in touch with manufacturers who may wish to employ them.

The courses are open for 10 months each year. Tuition is free. The programme of theoretical work comprises drawing from relief, technical drawing, elementary geometry, descriptive and applied geometry, perspective, and modeling.

The manual competitions occur every Sunday during the months of October, November, and December.

From 120 to 125 pupils are enrolled each year, the number in actual attendance averaging from 90 to 100.

Rewards are granted to pupils who complete the different courses, to apprentices entering the manual competitions, and to draftsmen in

the designers' competition. These rewards consist of savings-bank accounts, tools, drawing instruments, books, engravings, medals, and diplomas. The manual competitions are decided by juries composed of workmen and proprietors appointed by the patrons' association. The designers' competition is decided by a jury of four members named by the contestants and four by the association, who in turn select a presiding juror.

The total receipts of the school for 1899 were 11,309 francs ($2,183), of which amount 1,000 francs ($193) were received as a subsidy from the department of commerce, 6,500 francs ($1,255) from the city of Paris, 1,590 francs ($307) from membership fees, and the remainder from various sources, including 1,225 francs ($236) subscribed by individuals. The expenditures were 12,453 francs ($2,404) divided as follows: Salaries of teachers, 1,926 francs ($372); administration, 1,280 francs ($247); rent, 2,000 francs ($386); other expenditures, 7,247 francs ($1,399).

CORRESPONDENCE SCHOOL OF FLOUR MILLING, ETC., PARIS.

The establishment of this school was decided on at a conference of leading representatives of the milling industry and of the grain and flour trade of Paris, held on March 12, 1891. A committee of patronage and a council of administration and instruction were appointed and the school was opened on the first day of April following. The school has received the active support and encouragement of a number of organizations belonging to the grain and flour trade and kindred industries. It has also received the moral support of the chamber of commerce, the municipal council of Paris, and the ministries of public instruction, of commerce and industry, and of agriculture.

The plan of instruction pursued consists in publishing a series of questions on milling operations in the Milling Journal (*Journal de la meunerie*), the official organ of the school, which is sent to each pupil. Once a month the pupil mails answers to these questions to the administrative council of the school. The pupil's replies to the questions are graded in five degrees. The council prepares and publishes the correct answers from month to month, which the pupil may compare with his own work.

The design of this instruction is to combine the elements essential to regular trade courses, and to propagate in a practical way the idea of technical instruction for millers. The course is completed by written and oral examinations at Paris in September of each year, on which is based the conferring of a diploma, or a certificate of capacity or of aptitude, as the case may be. The holding of the annual examination at Paris enables the council to assemble in one place a number of the pupils, to give them lectures and demonstrations on milling apparatus, and to take them on visits to large modern mills in Paris

and its suburbs. At this examination prizes are awarded on the basis of the pupils' several returns on the questions.

The annual cost of instruction to pupil subscribers is 10 francs ($1.93), no charge being made for the copies of the Milling Journal.

The course opens November 1 and closes September 15. The programme is in seven divisions, the subjects embraced in each division and the details being as follows:

First division: Raw materials and mill products—A. Wheat: Varieties of native and foreign wheat; physical structure of wheat; chemical composition of the wheat grain; varieties of wheat commonly used in French mills; their nature and characteristic properties; impurities in wheat; diseases of wheat; parasites of wheat; transportation and warehousing; mixtures of wheat for milling. B. Flour: Kinds and comparative values of the flour admitted to the French markets; the testing of various kinds of flour, (1) for whiteness and purity, (2) for the quantity of gluten it contains, (3) as to the hygrometric conditions, and (4) for adulterants; warehousing of flour; chemical composition of flour. C. Brans: Chemical composition of brans; comparative qualities of the brans resulting from the different methods of grinding.

Second division: Cleaning—The apparatus necessary for cleaning; theory of cleaning; work and results obtained with each piece and with the combined apparatus; qualities which well-cleaned wheat must retain; washing; moistening of wheat; its utility according to the nature of the wheat; preparation of the grains for grinding; splitting degermers; rollers.

Third division: Grinding, etc.—A. Grinding with stones: Forms, dimensions, and arrangement of stones; velocity of stones; fitting the shafts (irons) of the stones; dressing and preparation of stones; embedding of the rynds; setting and balancing stones; cutting of the radial grooves and of the handles; mending; airing of the stones. B. Crushing with rollers: Outline structure of a roller apparatus and the details of its construction; theory of operation of rollers; gradual reduction (technically so called); materials of which rollers are made; importance of the choice of these materials; different methods of operating and controlling roller apparatus; blowing into such apparatus; ratio of the production of rollers to their dimensions and to the power employed; distribution of the crushing power; comparative product of each passing according to the method and system employed. C. Grinding by special machinery—Disintegrators and granulators: Technical description of each of these machines; operation and principles of grinding. D. Scourers: Systems, operation, and utility of scourers.

Fourth division: Reducing—Theory of reducing; apparatus for reducing grits to flour; reduction by millstones; reduction by porcelain or by smooth-cast rollers; reduction by disintegrators.

Fifth division: Bolting and sifting—Theory of these processes; the different systems; ordinary bolters; cylindrical bolters; centrifugal bolters; horizontal conduits; the fabrics for bolters and sieves—gauze wire cloths, French and foreign silks; installation of metallic tissue screens; repair and cleaning of bolter surfaces; installation of bolters in certain special systems of milling; theory of cleaning grits and semolina; finishers, bran brushes; flour mixers, baggers, elevators, automatic scales, etc.

Sixth division: Motive powers—Physical and mechanical principles; natural and artificial motive power; hydraulic motors; wheels with plane floats (undershot); wheels with curved floats (undershot); side wheels; bucket wheels (overshot); hanging wheels; turbines; determination of the motive power of streams; low water; high water; sluices; calculation of delivery of streams; direct fall; convertible fall; windmills; steam engines; gas and petroleum engines; electric motors; theory of speeds to be given transmitting elements (shafts, pulleys, and gearings).

Seventh division: General principles of the baker's trade—Operations of bread making; theory of bread making; preparation of the dough; practical and rapid ways of appraising flours. Leavens and yeasts—Their preparation; different states of the leaven; applying the leaven for kneading; dough working; preparing fresh leaven; saving over leaven; yeasts; beer yeast; grain yeast; working on yeasts; keeping of yeasts and leavens. Water in bread making: Temperature; quantity necessary; hydration of bread; bran water—its object and its inconveniences; use of salt; kneading; doughs; preparation of the dough; weighing; shape of loaf, etc.; setting the loaves in pans; various processes of bread making; kneading troughs—ordinary troughs and machine kneaders. Ovens—their construction; firing; baking of the bread; placing in oven; length of the baking; ways of keeping the oven steam; removing from the oven; distinctive quality of a good baking; steaming apparatus; pyrometers; different kinds of breads; keeping of bread; the various utensils used in the baking business.

The school numbers among its pupils not only apprentices and young workmen, but even foremen and superintendents of mills. The number of pupils on January 1, 1899, was 67. This shows a distinct loss from previous years. In 1896 the number was 119. The annual cost of maintaining this school amounts to only a small sum, the principal expense being for printing and cost of correspondence.

SCHOOL OF HORSESHOEING, PARIS.

This school was established in 1893 by the Journeymen Farriers' Union of the Department of the Seine. Its beginnings were difficult, owing to the lack of means, but a better organization was secured after it had received financial aid from the municipal council. Its aim is to impart theoretical instruction on every subject pertaining to the farriers' trade, and to supplement this instruction with some general ideas on the treatment to be given to animals while awaiting a veterinary's aid, in case either of accident or of disease.

The courses are given at the headquarters of the union and in subordinate sections in different quarters of Paris. They are given by three instructors under the supervision of the union's officers, and occupy an average of six hours a week. The programme comprises the fitting of all ordinary kinds of iron shoes, the modification of the shoe to suit any diseased condition of the foot, and first care of the horse in case of disease or accident.

The total attendance upon the main school and the different sections is about 350.

In 1899 the receipts of the school were 1,120 francs ($216), of which amount 500 francs ($96.50) were received as subsidy from the city of Paris. The expenditures were equal to the total receipts.

SCHOOL FOR APPRENTICES AND JOURNEYMEN IN THE HOUSE-FURNISHING TRADES, PARIS.

This school was founded in 1874 for the technical training of apprentices and workmen in the house-furnishing industry as cabinetmakers,

carvers, chair makers, joiners, wood turners, marquetry makers, upholsterers, pattern makers, sculptors on plaster, chasers, molders, billiard workers, molding makers, etc.

The governing board is composed of 15 members, of whom 5 are from the cabinetworkers' union, 5 from the wood sculptors' union, and 5 from the union of billiard workers of the Seine. Only members of the furniture trades unions are eligible for admission to the school.

The courses begin September 15 and close July 15. The programme comprises linear drawing, sketching and drafting of plans, architecture and perspective in relation to furniture making, decorative and ornamental carving, modeling, study of styles, and history of art—10 hours per week; molding, pattern making, and plaster sculpturing as applied to furniture making—4 hours per week; study of wood carving and assembling—2 hours per week. Five instructors are employed in the various departments. Tuition is free.

The receipts of this school consist of subsidies from the State, from the city of Paris, and from various trades unions. In the budget for the year 1899 these items are reported as follows: From the State, 800 francs ($154); from the city of Paris, 8,000 francs ($1,544); from the trades unions, 450 francs ($87). The total expenditures were 10,225 francs ($1,973), leaving a deficit of 975 francs ($188).

The total attendance on January 1, 1899, was 128 pupils.

TECHNICAL COURSES RELATING TO MASONRY MAINTAINED BY EMPLOYERS' ASSOCIATION, PARIS.

These courses were organized in 1890 for the purpose of giving to young men a thorough training in the theoretical branches pertaining to masonry and stonecutting. At first there were but 2 courses—one in linear drawing and geometry, and one for the study of construction in all its details. A course in stereotomy was added in 1892, and one in mensuration in 1897. These courses begin October 15 and end April 1.

The programme allots 4 hours a week to each of the four following courses: Elementary geometry and linear drawing; science of construction, with study of materials and building laws; measurements of work done (weekly visits to work yards); stereotomy (stonecutting), and drawing of diagrams. The instruction equipment includes tables, benches, drawing boards, squares, T-squares, paper, patterns, collections of plans, façades, models, etc.

The total attendance January 1, 1899, was 420.

The budget for 1899 shows a subsidy of 500 francs ($96.50) from the State and 200 francs ($38.60) from the chamber of commerce. A balance of 4,871.15 francs ($940.13) was contributed by the association. The total expenditures were 5,571.15 francs ($1,075.23).

TECHNICAL COURSES IN CUTTING MAINTAINED BY UNION OF MASTER TAILORS, PARIS.

These courses were organized in 1890 for the purpose of teaching cutting and finishing to young men who are without the means of paying for instruction. One of the chief aims of the school is to teach new methods. The courses are directed by the council of the union, mainly through its president and general secretary. The sessions are held in the assembly room of the union on Wednesday evenings, beginning at 8.30 o'clock. The programme covers particularly the following features:

Cutting of garments for men, women, and children, and of military clothes, by the ordinary process of proportion; explanation and use of the more scientific systems of "integral measurement" and "triangulation;" studies in finishing and in the difficult parts of the trade; reciprocal instruction; demonstration of the different tools and appliances used in cutting; ordinary business principles.

The sessions are supplemented each evening by lectures on points suggested in the evening's work. The instruction equipment comprises tables covered with black cloth for marking out, several manikins and busts of normal and abnormal forms, squares, rules, and other instruments, and a technical library containing works on all the methods of cutting taught by the instructors.

The attendance varies from 80 to 100. All the pupils adopt the tailors' trade, beginning as journeymen cutters. Some of them eventually become foremen of shops.

COURSES OF THE POLYTECHNIC ASSOCIATION, PARIS.

This association for popular instruction was founded in 1830. Its purpose was "to spread among the laboring classes the instruction which forms the basis of our modern society." Beginning with 14 courses in 1830, it grew steadily until during the school year 1898–99 there were 678 courses. The association has 24 branches in Paris and several in the suburban communes. It has, in addition, organized various other societies in Paris, in the departments, and in the colonies.

The courses of study are free and are given in the evening. They cover a wide range of subjects and are intended for all classes of industrial and commercial employees who desire to continue their education. The teachers are recruited from the various professions, namely, civil and mechanical engineers, lawyers, physicians, authors, artists, accountants, publicists, officials, etc.

The subjects taught may be grouped into six general divisions, namely, industrial, commercial, art, agricultural, physical culture, and general courses.

The following table shows the total number of hours per week during which classes are held in each of the industrial or trade branches:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE INDUSTRIAL AND TRADE COURSES OF THE POLYTECHNIC ASSOCIATION, PARIS.

Subjects taught.	Total lessons per week.	Total hours per week—all classes.			
		First year.	Second year.	Third year.	Fourth year.
Architecture	6	9	9	9	9
Artificial-flower making	2	2	2	4	4
Automobile construction	2			2	4
Boiler and steam-engine tending	3	4	4	6	6
Chemistry	14	14	16	20	24
Garment cutting and sewing	29	30	38	42	4
Industrial electricity	5	10	10	10	10
Industrial drawing, styles of furniture	11	8	9	12	15
Machine fitting	2	2	2	2	2
Mechanics	5	8	8	10	10
Modeling	6	6	10	12	12
Painting on porcelain and on fans	17	20	26	28	30
Photography	15	10	15	20	24
Physics	10	8	10	10	14
Stonecutting	1	2	2	2	2

The association possesses a library of about 1,000 volumes, apparatus for demonstrations, and a collection of models, views, etc.

At the close of each school year a prize competition is held for each branch of study. In order to enter the competition pupils must have attended at least two years. The prize winners receive medals and books, together with certificates specifying the nature of the prizes won.

The following table shows the number of pupils in attendance on January 1 of each year from 1895 to 1899:

ATTENDANCE ON ALL COURSES OF THE POLYTECHNIC ASSOCIATION, PARIS, 1895 TO 1899.

	Nature of instruction.						Total attendance.
	Industrial courses.	Commercial courses.	General courses.	Art courses.	Agricultural courses.	Physical culture.	
1895	2,420	5,200	1,770	1,200	120	90	10,800
1896	2,600	5,510	1,980	1,500	115	95	11,800
1897	2,750	5,990	2,100	1,950	127	103	13,020
1898	3,062	6,120	2,023	2,005	135	105	13,450
1899	3,115	6,175	2,040	2,023	137	110	13,600

The total receipts and expenditures during 1899 were as follows:

RECEIPTS AND EXPENDITURES OF THE POLYTECHNIC ASSOCIATION, PARIS, 1899.

Receipts.	Amount.	Expenditures.	Amount.
Subsidies:		Compensation of general agent	$165.93
From the State	$1,544.00	Rents	127.77
From the city of Paris	2,895.00	Furniture and materials	191.65
From various associations	164.05	Printing, advertising, publications, etc	1,301.80
From private persons	540.64	Medals, prizes, and books	956.83
Donations from the teachers	345.90	Instruction	2,139.27
		Miscellaneous	239.42
		Surplus	366.92
Total	5,489.59	Total	5,489.59

SOCIETY FOR TRADE AND TECHNICAL INSTRUCTION RELATING TO MARINE FISHING, PARIS.

This society was organized in 1895 for the purpose of diffusing among sea fishermen the knowledge needed for lessening the dangers of their trade and for drawing from its practice the greatest benefit possible. No previous effort to provide such instruction had been made in France. To accomplish its purpose the society has procured the creation of special fishing schools in a number of maritime towns. The most important schools of this class are those at Les Sables and Marseille, which are municipal; one at Boulogne-sur-Mer, which is attached to the agricultural station at that place; one at Dieppe, which was created by the local board of trade; and schools at Le Croisic, Arcachon, and Philippeville, which are maintained by local associations. Schools are still directed by the society at Groix, La Rochelle, and Le Treport. These three schools receive subsidies from the ministry of marine, the central Government having decided that a portion of the money annually granted to encourage the deep sea fisheries should be devoted to such schools. These various schools are under the patronage of the boards of trade of their respective localities. Instruction is, as a general rule, given in buildings provided free of cost by the municipalities or boards of trade. At Marseille and Boulogne-sur-Mer the schools are installed on old war vessels donated for their use by the ministry of marine and fitted up for the purpose of instruction. At Marseille the pupils holding scholarships are lodged on board.

The instruction varies according to the needs of the fishermen in the different localities. Thus, at Boulogne-sur-Mer, where steam fishing boats are used the programme is more extensive than at Groix, where only sailboats are employed.

At Marseille the programme of instruction is more comprehensive than in the other schools. Two years are required to complete the course. Complete instruction is given in all that relates to the fishing industry, the making, repairing, and placing of nets, the habits of fish and other sea animals useful as food, the management of vessels, the elements of medicine and care of the injured, sea currents, geography, elements of geography, etc. In all the schools courses are given in navigation, handling of nets, social economy, and first care of the injured. The theoretical instruction is supplemented by practical exercises on the sea. A résumé of the apparatus used will give an idea of the practical character of the instruction imparted. This comprises the instruments needed for taking bearings (sextants and octants), mariner's compass, log, charts, emergency medicine chests, models of various fishing machines, tools and apparatus for exercises in handling sail rigging, and in taking up and repairing fishing gear; also a technical library, etc.

The society completes its work by organizing competitions, conferences, and exhibitions, and by publishing works intended to popularize knowledge in its field. It proposes to give the diploma of fishing master to pupils acquiring the requisite knowledge.

The total receipts of the society for the year 1899 amounted to 16,817 francs ($3,246), of which 6,500 francs ($1,255) represented the subsidy from the National Government.

COURSES OF THE PHILOMATIC SOCIETY, BORDEAUX.

This society was founded in 1808, and is thus one of the oldest private associations for the advancement of popular and technical knowledge in France. It is the successor of the Museum of Public Instruction, founded in 1783.

Its first energies were devoted to a course of general education. As its activities became more widespread it began, in 1839, to devote itself to the organization of courses of instruction for adults. Later it gave to these courses an almost exclusively industrial and technical character. Since 1874 it has been charged with the administration of the Superior School of Industry, at Bordeaux. One of its means of encouraging industry is the holding of industrial and art exhibitions.

Eight school buildings are utilized by the society for its classes, which open on October 15 and close June 15. Pupils must be at least 15 years of age, must pass an entrance examination, and pay a matriculation fee.

The courses of instruction include reading, penmanship, arithmetic, geometry, algebra, accounting, grammar, physical and commercial geography, stenography and typewriting, English, German, and Spanish languages, geometrical and industrial drawing, ornamental drawing, art applied to industry, mechanical drawing, architectural drawing, drawing for the coach-making industry, physics and chemistry applied to industry, modeling and wood carving, stonecutting, wood joinery, carpentry, cabinetmaking, upholstery, shoemaking, tailoring, boiler making and forge work, machine fitting, locksmithing and wrought-iron work, boiler and engine tending, wine making, commercial law, cooking, garment cutting, embroidery, dressmaking, and weaving.

Instruments, apparatus, and tools are provided for practical demonstrations. The society also possesses a commercial and industrial museum and a library.

The following table shows the attendance on January 1, of each year from 1895 to 1899, on the various courses maintained by the society:

ATTENDANCE ON THE VARIOUS COURSES MAINTAINED BY THE PHILOMATIC SOCIETY, BORDEAUX, 1895 TO 1899.

Year.	Industrial courses.	Commercial courses.	Total.
1895	1,350	1,074	2,424
1896	1,801	1,435	3,236
1897	1,893	1,398	3,291
1898	2,092	1,614	3,706
1899	1,998	1,777	3,775

Following is a statement of the receipts and expenditures of the society:

Receipts:	
Contributions—	
From the State	$2,123.00
From the department	386.00
From the city of Bordeaux	1,930.00
From the chamber of commerce	926.40
Assessments of members	6,500.24
Tuition fees	734.37
Other receipts	5,515.57
Total	18,115.58
Expenditures:	
Salaries of teachers, etc	7,631.11
Materials and other expenses	10,172.98
Surplus receipts	311.49
Total	18,115.58

COURSES OF THE RHÔNE SOCIETY FOR TRADE EDUCATION, LYON.

This society was organized at Lyon in 1864 for the purpose of establishing courses of instruction for adults, especially trade and technical courses for workmen, apprentices, and clerks. It was intended to fill a void, the importance of which has been demonstrated by the subsequent progress of the society's work. The organization resembles those of Paris, except that the pupils pay matriculation fees of from 3 to 6 francs ($0.58 to $1.16), according to the nature of the course. Since its foundation no changes have been made in the plan of organization, but the number of courses has greatly increased.

The classes maintained by the society are in session on week days from 8 to 10 p. m. from October 1 to March 31. Sunday morning sessions are also held during this period. Sessions are held in different parts of the city.

The instruction comprises industrial, commercial, and general branches, separate courses being given for male and female pupils.

The following statements show the subjects taught in the industrial department and the hours per week devoted to each:

HOURS PER WEEK DEVOTED TO EACH SUBJECT IN THE INDUSTRIAL DEPARTMENT, RHÔNE SOCIETY FOR TRADE EDUCATION, LYON.

INDUSTRIAL COURSES FOR MALES.

Subjects.	Hours per week.			
	First year.	Second year.	Third year.	Fourth year.
Applied mathematics	2	2	.....	.....
Strength of materials	1	.....	.....	.....
Descriptive geometry and stonecutting	2	.....	.....	.....
Physics and chemistry	2	.....	.....	.....
Electricity	2	2	.....	.....
Theory of manufacturing	4	2	2	.....
Study of spun threads	2	.....	.....	.....
Practical weaving	3	3	.....	.....
Trade drawing for joiners	4	4	.....	.....
Drawing with cord (diagramming)	4	.....	.....	.....
Trade drawing for locksmiths	4	4	.....	.....
Ornamental hammered work	4	.....	.....	.....
Trade drawing for tinsmiths	4	4	.....	.....
Trade drawing and cutting for upholsterers	6	6	.....	.....
Trade drawing for machinists and coppersmiths	2	2	.....	.....
Trade drawing for coach makers	4	4	.....	.....
Cutting for tailors	3	3	.....	.....
Cutting for shoemakers	1½	.....	.....	.....
Practical work for shoemakers	1½	.....	.....	.....
Linear drawing	2	.....	.....	.....
Trade drawing for carpenters	4	4	.....	.....
Industrial drawing	6	6	6	6
Photography	1	1	.....	.....
Perspective	2	2	2	.....
Administrative law	2	.....	.....	.....

INDUSTRIAL COURSES FOR FEMALES.

Subjects.	Hours per week.			
	First year.	Second year.	Third year.	Fourth year.
Sewing, cutting, dressmaking, and linen goods embroidery	2	2	2	.....
Drawing for embroidery work	4	4	4	.....
Embroidery	4	4	4	.....
Millinery and novelties	2	2	.....	.....
Physics and chemistry	2	.....	.....	.....
Photography	1	1	.....	.....
Industrial drawing	6	6	6	6
Perspective	2	2	2	.....
Perspective drawing	2	2	.....	.....
Painting	2	2	2	2

All of the special technical courses, such as those for carpentry, locksmithing, tinsmithing, upholstery, jewelry making, wagon making, machinery, tailoring, shoemaking, etc., are installed, with proper appliances for each trade, in the building that the society has had specially constructed

It is of interest to get the exact point of view of the society in respect to its efforts for technical education. This it has very clearly stated in the following quotation from a pamphlet which it prepared for the Paris Exposition of 1889:

It is useful to explain what the society means by trade education (*enseignement professionnel*). For a great many persons trade education means manual exercises or an apprenticeship, more or less com-

plete, in a trade. The society gives no such meaning to the expression. It offers no apprenticeship system, nor manual work, or at least no manual work other than that necessary for showing the direct application of the theoretical instruction given in its courses. Thus, carpenters make models in wood as an application of their courses in drawing; the locksmiths make wrought-iron ornaments as a complement of their work in drawing; the stonecutters and builders make plaster casts in execution of their sketches in class. But apprenticeship, properly speaking, nowhere exists in our courses. We speak of trade education and not apprenticeship in a trade. The instruction given in each trade is only the theoretical knowledge necessary in the intelligent exercise of the trade. As to apprenticeship itself, the society believes that it should be given in the shop and not in the class room.

These ideas are the same as those which underlie the system of industrial schools of Belgium.

The educational department is managed by a board consisting of five members, one of whom is the director of the society. The teaching personnel consists of 30 instructors in the industrial course, 13 in the courses for females, and 18 in the commercial courses.

The following table shows the attendance on the 1st of January of each year from 1895 to 1898:

ATTENDANCE IN INDUSTRIAL AND COMMERCIAL COURSES OF THE RHÔNE SOCIETY FOR TRADE EDUCATION, LYON, 1895 TO 1898.

Year.	Industrial courses.		Commercial courses.	
	Average per course.	Total.	Average per course.	Total.
1895	35	1,939	41	1,379
1896	35	2,072	43	1,377
1897	37	2,268	43	1,376
1898	40	2,545	45	1,541

The work done by the pupils is examined at the end of each year by the administrative board and the director of the society. The work done in some of the courses, such as ornamental and figural drawing, modern languages, etc., is passed upon by a board consisting of competent persons who are not members of the society. Awards are given to pupils. They consist of honorable mention, gold, bronze, and silver medals, books, and bank accounts, these last mentioned being offered by various associations.

Following is the budget of this school for 1899:

Receipts:

Contributions—

From the State	$2,509.00
From the department	1,158.00
From the city of Lyon	3,474.00
From the chamber of commerce	1,158.00
From trade unions	112.91
From various associations	326.17
From individuals	945.70

Receipts—Concluded.	
Assessments—	
From active members	$786.86
From honorary members	567.42
Tuition fees	4,519.29
Receipts from other sources	415.07
Total receipts	15,972.42
Deficit	304.35
Total	16,276.77
Expenditures:	
Teaching personnel	8,641.39
Director and administrative personnel	1,930.00
Rent, insurance, heat	3,276.14
General expenses	810.71
Materials, library	256.14
Distribution of prizes	512.08
Printing	258.62
Miscellaneous expenditures	591.69
Total	16,276.77

INDUSTRIAL DRAWING SCHOOLS.

The object of these schools is perhaps indicated with sufficient clearness in the above title. They are institutions in which drawing is taught in view of its application to particular classes of industrial work. In some schools modeling is an important part of the work.

A list of cities which contain the best examples of these schools has been given in the introduction. Descriptions of a few schools follow.

MUNICIPAL DRAWING SCHOOL, CAMBRAI.

This school was created in 1868, its object being to teach pupils the application of drawing to the arts and manufactures.

The course of instruction covers three years and comprises the study and applications of geometrical principles, free-hand drawing, and drawing from nature and from sketches. It is divided into three sections, viz, construction, mechanics, and general drawing. Six hours per week are devoted to each of the following subjects: Geometrical outlines, side-view sketching, pen drawing, scale drawing, study of sections or cuts, mechanics, carpentry, general studies.

Supervision over the school is exercised by a board consisting of the mayor of Cambrai and 11 associates. Two instructors constitute the teaching personnel.

The attendance on January 1, 1899, was as follows: First-year class, 46; second-year class, 19; third-year class, 10; making a total of 75. The number of graduates during the five preceding years was as fol-

lows: 1894, 29; 1895, 35; 1896, 33; 1897, 40; 1898, 25. The expenses of the school are met by subsidies of 1,000 francs ($193) from the city of Cambrai and 3,000 francs ($579) from the State.

THE GERMAIN-PILON SCHOOL OF INDUSTRIAL DRAWING, PARIS.

This institution was acquired by the city in 1882 at the same time that the Bernard-Palissy school of industrial art (which has been described) was made a municipal institution. It was formerly a private school receiving a municipal subsidy. Candidates for admission to this school must be of French nationality and at least 14 years of age, or 13 if provided with the certificate of primary education. Candidates are required to pass a preliminary examination consisting of an exercise in geometrical drawing and perspective of an object of very simple form and a written composition. The examination furnishes a means of excluding applicants who do not possess a sufficient primary instruction or who show no aptitude for drawing.

In this school the pupil is taught drawing in general. The only aim is to prepare him for entering the art industries; that is, he is taught drawing simply with a view to its industrial application. The regular course of studies is of three years' duration. Tuition is free. The principal instruction is given during the day, both morning and afternoon. There are also evening courses. The programme is as follows:

First year: Geometry, decoration and architecture wash and water color work; history of art; drawing and modeling.

Second year: Perspective, anatomy, geometrical drawing in wash color, lace work, furniture ornamentation, history of modern art, practical exercises in molding.

Third year: Perspective, with application to buildings and furniture, the study of styles and of decorative composition, furniture ornamentation, etc.

The number of pupils enrolled on January 1, 1899, was 101. Of this number 63 were in their first year, 23 in their second year, and 15 in their third year. The number of graduates in 1899 was 19.

On completing their studies the pupils readily find employment in private establishments on account of the knowledge they have gained. Their income at the beginning is rarely less than 100 francs ($19.30) per month; often it is more, and in all cases it is soon increased. An association of the alumni, recently formed, will eventually assist in procuring desirable situations for the graduates. The Lace Trade Exchange has undertaken to secure places for 5 pupils each year.

The municipal council has assisted many pupils to remain in school during the full three years' course. This aid has been accomplished by the establishment of a system of premiums, to be accorded to pupils whose parents are financially embarrassed. The amount of the gratuity varies according to the application, work, and progress of the pupils receiving it. It averages 150 francs ($28.95) for the second year and 250 francs ($48.25) for the third year. In special instances

the city has allowed sums of 300 to 600 francs ($57.90 to $115.80) to maintain pupils in the school.

General competitions are arranged at the close of the school year. Pupils can not pass from one year to the next unless they are recognized as apt to profit by the instruction during the following year.

The cost of maintaining the institution in 1899 was 54,775 francs ($10,572), of which amount 46,975 francs ($9,066) were required for salaries.

GIRLS' DRAWING SCHOOL OF THE SECOND ARRONDISSEMENT, PARIS.

This school consisted, until 1895, of a special course in drawing arranged to conform to the programmes for the drawing schools of the city. In January of that year the new directress added to this industrial instruction designed to assist young girls to a means of earning their own livelihood. The course of instruction covers 4 years, the number of hours per week devoted to each subject being the same for all years. The programme embraces: Drawing, 9 hours per week; decorative composition, 2 hours per week; history of art, one-half hour per week; perspective, 1½ hours per week; anatomy, 1 hour per week; painting (aquarelle, gouache, oil) porcelain, fans, miniatures, and imitation of tapestry, and plant and flower drawing from nature—6 hours per week. On January 1, 1899, the school had 61 pupils.

The following table shows the occupations entered by the graduates of the school during the period, 1896 to 1899:

OCCUPATIONS OF GRADUATES OF THE GIRLS' DRAWING SCHOOL OF THE SECOND ARRONDISSEMENT, PARIS, 1896 TO 1899.

Year.	Fan makers.	Miniature painters.	Pattern designers—		Teachers.	Commercial occupations.
			For embroidery.	For furniture.		
1896	3				1	
1897	4				3	3
1898	2	2	2			
1899	2	1		3		1

The subsidy received from the city of Paris in 1899 was 2,000 francs ($386).

GIRLS' DRAWING SCHOOL OF THE TENTH ARRONDISSEMENT, PARIS.

This school was opened in October, 1895, at No. 40 Rue du Faubourg Saint Martin. After a year's operation the attendance became so large that the school was moved to its present location (No. 69) in the same street. The aim of the school is to prepare women for occupations which afford an honorable means of subsistence and which are

also elevating in character. It is a day school, but evening courses have been organized for the benefit of girls occupied during the day.

The instruction in drawing covers three grades, viz, object drawing, scientific drawing, and inventive drawing, the latter exercising the pupils in industrial composition and enabling them to apply the skill and knowledge acquired. The day courses are arranged in three divisions: Oral courses, object drawing, and industrial painting. The evening courses embrace the same divisions, except that of painting. Two years' attendance, at least, is regarded as necessary to complete the courses, particularly that of object drawing; there is no fixed limit of time.

The pupils of the school are distributed in three sections, according to their skill. There is a fourth section for the small number who are preparing to teach drawing and are studying chiefly the examination programmes. The work in the several sections and the hours per week devoted to each subject are as follows:

Oral courses: First section—Perspective and geometry, 1 hour. Second section—Decorative composition, 2 hours; perspective, 1 hour; history of art, 1 hour. Third section—Decorative composition, 2 hours; perspective, 1 hour; anatomy, 1 hour; history of art, 1 hour.

Object drawing: First section—Ordinary objects, plant elements, simple plaster casts, 13 hours. Second section—Study of plant forms, ornaments, and heads from plaster, 13 hours. Third section—Living models, academic figures, 13 hours. Fourth section—Same as for third section, 1 hour.

Industrial painting: Second section—Aquarelle, gouache, and porcelain work, 6 hours. Third section—Oil painting, pastel work, 12 hours; aquarelle, gouache, and porcelain, 9 hours.

Most of the graduates of this school make practical use of their education, becoming miniature and fan makers, porcelain painters, pattern drawers in embroidery and lace work, designers for publishers, fashion-plate engravers, and embroiderers.

The total receipts of the school for 1899 were 3,369 francs ($650), of which 1,500 francs ($289) were received from the city and 1,869 francs ($361) from tuition fees.

On January 1, 1899, the number of pupils was 117, of whom 66 were free scholars. The attendance was thus distributed: First section, 32; second section, 54; third section, 31.

GIRLS' DRAWING SCHOOL OF THE EIGHTEENTH ARRONDISSEMENT, PARIS.

This school, located at 7 Rue Flocon, was founded in October, 1885, to prepare young girls for places as teachers in the drawing schools of the city. Since then there have been added special courses in decorative composition, in water color applied to the industrial arts, and in miniature work, so that the school now prepares pupils either to teach drawing in the State and municipal schools or to practice the trades in which drawing and painting are the chief factors.

All the pupils here follow the same course of studies, the programme of which, comprising 3 sessions a week, is as follows: Sunday, drawing from life and miniature work, 8 a. m. to 12 m.; Monday, water color (flowers), still life, and decorations, 7.30 to 10 p. m.; Friday, studies from plaster casts and from ordinary objects, elements and application of decorative composition, 7.30 to 10 p. m.

The subsidy from the city for the year 1899 was 2,000 francs ($386). The number of pupils in attendance on January 1 of that year was 76.

ATTITUDE OF EMPLOYERS AND GRADUATES OF TRADE AND TECHNICAL SCHOOLS TOWARD TRADE AND TECHNICAL EDUCATION.

Before entering upon a consideration of the attitude of employers and graduates of trade and technical schools toward trade and technical education, it is of interest to present the statements of M. Isidore Finance, an official of the French labor bureau of the ministry of commerce and industry, concerning the results of a trade-school education to the graduate and the attitude of labor organizations toward trade schools. This gentleman occupies a position which brings him directly in touch with trade unions and affords a basis for his views.

His statement in regard to the effects, as he sees them, of a trade-school education on the graduate is substantially as follows:

On entering the workshop the graduate is inevitably obliged to devote himself to one of the special branches of his trade. He has to encounter young men of his own age who do not have the general knowledge of the trade that he possesses, but who, having spent in the workshop the same number of years in the exercise of that special branch that he has passed in the school, have acquired exceptional skill and earn wages in proportion to their skill. The graduate does just as good, or even better, work than the shop-trained youth, but he has not been taught to calculate the value of time, because in the school more attention is paid to the quality than to the quantity of work done. On entering the shop or factory, then, the graduate works very slowly and, moreover, as he has never worked on articles that are to be disposed of in the market, he does not know that the finish to be given to articles of equal stability, etc., may be greatly varied according to their destination or use. The employer can, under the circumstances, offer him only a wage much inferior to that earned by shop-trained boys of his own age, which is a cause of much humiliation to him. He is proud to have been among the minority admitted, after competitive examination, into a trade school. He thinks he should be permitted to enter directly into the aristocracy of the trade, and does not care to recognize the necessity of serving a new apprenticeship in the shop. The disadvantage at which he finds himself and the jibes of his fellow-workmen cause him eventually to

leave his first place of employment for another, where the same disappointments await him. It is true, if the graduate is able to overcome the wounds given to his pride and to resign himself for some time to the false situation in which he finds himself as compared with the shop-trained apprentices, there is no doubt that he will become a finished workman and will eventually rise above his fellows, but few young men are capable of making the moral sacrifices entailed by such a course and many quit the trade forever after the first few disappointments.

With regard to the present attitude of trade unions toward trade schools and trade education he said that the trade unions were at first absorbed in the difficulties incident to their organization and appeared to neglect trade education, but to-day they are endeavoring to regain the time lost, and, whether created by local unions, federations, or labor exchanges, there is noticeable a rapidly increasing number of trade courses, open during the evening or on Sunday morning, for apprentices and, above all, for young workmen. The apprentice does not always recognize the utility of these courses and, being fatigued by the day's work, is with difficulty induced to attend them. The young workman, however, after his apprenticeship is terminated, feels the need of enlarging his technical knowledge in order to obtain a higher wage and greater steadiness of employment. He is also more capable of understanding the lessons than the apprentice. He readily enters into the spirit of the unions which aim to make the trade instruction serve their propaganda. The unions rightly count upon the adherence of those who shall have profited by the courses, and they know that their claims will be heard more favorably by the employers when labor is well organized. Above these special considerations, however, must be placed a more general sentiment—that pride of profession which makes its advancement and practical superiority to be desired.

M. Finance further states that information derived from numerous sources enables him to affirm that the administrators of the principal trade unions who have caused their sons to learn trades have placed them directly in the shops. They have kept them away from the trade school in order to avoid the consequences already spoken of. He believes that shop apprenticeship, combined with the evening school, will produce more satisfactory workmen than the genuine trade school, and that such a system should be resorted to unless the principal aim is to produce clerks, designers, or overseers.

ATTITUDE OF EMPLOYERS.

AUTOMOBILE MANUFACTURE.

An incomplete statement was received from an automobile manufacturing concern at Audincourt (Doubs). This firm employed about 700

hands, of whom one-thirtieth were said to have attended a trade school. The proprietors stated that workmen having a trade-school education are preferred over others; that the trades in that industry requiring a formal apprenticeship are those of fitters, turners, joiners, painters, and leather workers; and that the trade schools can replace the shop apprenticeship in all of those trades.

BARBERING AND HAIR DRESSING.

A statement was received from a master barber and hairdresser of Marseille who employs three workmen, all of whom have attended evening trade schools. He prefers employees with a trade-school training. Such training is most necessary in respect to ladies' hairdressing, and, in fact, it would be impossible, he says, for young men to learn this branch and do work on false hair (wigs, etc.) without the trade-school training. This employer encourages the work of the schools and sends his sons to them. He further states that school training leads to better work, more delicate finish, etc., than shop training, and that employees who have had the benefit of trade-school instruction more readily secure places and at better wages than others. He pays more for school-trained workmen than for those who have had no school training.

BRONZE GOODS.

A statement was received from a bronze-goods manufacturer of Paris who occupied the position of secretary to the association of manufacturers of bronze goods and similar articles.

He briefly stated that for the artistic work, such as bronze chasing, for instance, a trade-school training is desirable, and that graduates of such schools are preferred; but that for the more practical or productive work, as mounting, etc., the graduates are not so satisfactory, for the reason that there is not enough practical work done in the schools to fit them properly for shop work. The principal institution in Paris in which these trades are taught is the Boulle Municipal School of Furniture Making. It is hoped, he adds, that an arrangement will be made whereby the requisite amount of practical training may be provided by allowing students to spend their afternoons in the shops of manufacturers during their last two school years. By such an arrangement students would become familiar with rapid methods of production. The only trade in which the school training can at present replace shop apprenticeship is that of chasing. With the improvement suggested above, however, mounting may also be properly taught in the school.

JOINERY.

A master joiner at Paris, having four workmen in his employ, two of whom have received some trade-school instruction, stated that he

prefers to employ those having a school training because they possess the advantage of being able to prepare plans and work by drawings, etc. All joiners, he says, have need of a knowledge of drawing. While the trade school proper can not replace the shop apprenticeship, the evening schools are of great use, and employees should be urged to attend them. He believes that these schools should be established in every trade center and attendance on them by apprentices made obligatory.

PAPER AND PAPER GOODS MANUFACTURE.

Statements were received from two Parisian firms engaged in the manufacture of paper. Each employs from 50 to 60 persons, but no definite answer was returned as to the number of employees who have been to a trade school. Both, however, require their apprentices to attend the evening school for paper and paper goods making established by the employers' association. The full title of this school is "*L'École professionnelle de la Chambre syndicale du papier et les industries qui le transforment.*" There is not much specialization in the paper industry and there is no part of the work that requires a trade-school education more than another. Both employers (firms) report that to become a paper maker (*ouvrier papetier*) a shop apprenticeship is necessary. The evening school mentioned above, although relating entirely to the industries of paper and paper goods making, is not intended to take the place of shop apprenticeship, but to furnish merely a complementary instruction. As one employer expressed it, the school is intended only to facilitate the learning of a trade by the apprentice and to complete the trade knowledge of the shop-trained workman. The courses are intended to teach pupils to work intelligently by leading them to discover the reasons for doing things. One employer, speaking more generally of trade schools, said they hardly ever develop the skill in pupils that is brought out in factories, although their graduates have a broader knowledge of the trade. In his (the firm's) opinion the trade school proper is more suited to the needs of employers' sons than to those of workmen.

One employer stated that the trade school has been of advantage to the firm in enabling it to secure better workmen, foremen, office employees, etc., and that graduates can more readily find positions, earn better wages, and advance more rapidly than other workmen. Both employers agree that the trade school raises the level of trade knowledge and produces better workmen. They believe that for most industries the combination of shop apprenticeship with the evening school produces better results than does the trade school proper. One employer, however, excepts trade schools for art workers. Both affirm that graduates do not usually desire to remain at their places in the mill. They wish promotion to the warehouse and office force, etc.

One, in speaking of changes that should be introduced into the present methods of training in trades, remarks that the apprenticeship law should be modified so as to allow the employer more authority, and that parents and apprentices should be held more closely to the terms of the contract. On the other hand, he adds, the employer should allow the necessary time for the apprentice to attend the supplementary courses.

PRINTING AND PUBLISHING.

In 1863 the Chaix Printing and Publishing Company, of Paris, established a trade school in their establishment in order to provide competent workmen for the different branches of their industry. M. Alban Chaix, the administrator-director of the company, stated that of the 1,200 persons employed in the establishment 250 were graduates of the company's school. In this school the instruction is given during the day and is intended both to complete the primary education of apprentices and to provide them with the necessary technical training. Workmen are prepared for all the printing trades, but more particularly for that of compositor, which is the only trade in which M. Chaix believes school training can entirely replace shop apprenticeship. For some trades, as those of designer, lithographer, stereotyper, paper maker (*papetier*), and bookbinder, a special shop training in addition to that received at the school is required.

He states that in general the trade-school graduate possesses a better knowledge of his trade than others, hence he is more useful and can more readily find employment, gain higher wages, and advance more rapidly. Most of the company's foremen and all of their clerks are graduates of their trade school, as are many of the chief workmen and others occupying the best-paying positions. He says that work done by the better workmen who have been graduated from the school is more artistic and serves as an aid to the progress of the industry; also that trade schools in which the practical work is well directed afford a better means of educating workmen than does the shop training. He believes, furthermore, that the most important improvement that could be introduced into the system of apprenticeship and trade-school education would be to combine the theoretical and practical instruction of both in such manner as to produce workmen able to earn journeymen's wages upon the expiration of their term of apprenticeship. This he would accomplish by means of a school established, when possible, in the shop for which it is destined to supply workmen. In conclusion he adds: "Limit the number of pupils to the needs of the industry and endeavor to form good workmen of them."

RAILROAD SERVICE.

The director of the State railroads stated that no distinction is made between men trained in industrial establishments and those who have

been to trade schools when new employees are to be taken into the service. Those of the latter class, however, rise more easily to the position of foremen, etc., in the management or more rapidly pass by the grades of fireman and engineer to that of chief engineer, subchief of station, etc., in the traction service. He stated that all the employments of the shops—machine erection and fitting, boiler making, blacksmithing, molding, joinery, etc.—require a previous training or apprenticeship on the part of the person employed and that, in general, a trade-school education may replace a shop apprenticeship.

The advantages of a trade-school education are, he says, to give instruction to workmen which will enable them to comprehend more readily the operation of the machinery they employ, the reasons for the processes they apply, the conditions to be fulfilled in the work they do, to read the plans they must follow or to make sketches themselves if necessary, and to conceive of improvements to be applied to machinery or to processes, etc. He adds that it also permits the recruitment of the personnel of the management from among workmen who know thoroughly the theory and practice of the trades. Very few graduates remain in the lower grades of service, most of them quickly becoming designers, gang bosses, foremen, or machinists.

RAILWAY CAR AND ENGINE BUILDING AND REPAIRING.

A statement was received from an official of the Eastern Railroad Company relative to the employment of trade-school graduates in the locomotive construction and repair shop at Epernay and the car construction and repair shops at La Villette (Paris), Mohon, and Romilly-sur-Seine. In the four shops 3,714 persons were employed and of these 522 were graduates of trade schools. This official states that graduates of trade schools are preferred over others seeking employment in the shops. A trade-school training, he said, is useful in all trades in which a ready knowledge of plans and drawings and an ability to read them are useful or necessary. Trade schools have, in a general way, contributed to the forming of better workmen, as a result of which better work is done and at less cost. In none of these four shops, he states, can apprenticeship be wholly replaced by the instruction given in the trade school, because the graduate on leaving school can not have acquired sufficient special practice in the trade he expects to follow, but the period of shop apprenticeship may be much shortened, according to the special nature of the trade and the instruction received in the school.

The railroad company makes special efforts to instruct young workmen. A trade school for apprentices has been created in each shop, and at Epernay the company subsidizes the evening courses which are outside the shop.

Pupils leaving the trade schools, he says, have had at the same time

both theoretical and practical instruction and are nearly always superior to those who have completed only the purely manual apprenticeship. The former can do better work and reduce the net cost. It is among them that it is possible to recruit directing agents, gang bosses, foremen, etc.

STAINED-GLASS MANUFACTURE.

Statements were received from the director of a Parisian firm that manufactures stained window glass, etc. The firm employed 38 men, of whom 4 were graduates of a trade school and occupied positions as designers. The director stated that, with the exception of designers, the industry draws but few employees from among trade-school graduates. All the occupations require a special apprenticeship, but designers can obtain a useful preparation in the trade schools. He thinks the trade school can serve only to shorten apprenticeship in the industry and not to replace it. He added that many of their young men attend evening schools to learn drawing. Speaking generally of the advantages to be derived from trade-school education, he said it develops in young men a taste for study and helps them to comprehend the various parts of their work. In regard to the improvements that should be made in the trade-school system, he believes that after the elements of theory involved in the trade are taught the practical part should be brought more and more to the front.

STRUCTURAL IRONWORK.

The director of a firm of structural ironworkers of Paris stated that while there were no trade-school graduates in his employ when this investigation was made, he prefers such graduates if they have previously served one or two years in a manufactory. All specialties are better understood and consequently better and more rapidly executed by workmen who understand sketches and plans. The most important benefit derived from trade schools, he thinks, is the raising of the professional, moral, and social level of the workman and the higher opinion of the trade which is developed in him.

In regard to the changes that should be made in the system of apprenticeship and the training of workmen, he suggested that it would be well to require of all contractors or chiefs of industry that the apprentices in their establishments be methodically instructed and that quarterly examinations be held for the purpose of acquainting the employer with the amount of progress made by the apprentices and the measures needed to improve their general condition, etc.

WATCHMAKING.

A watch manufacturer of Cluses stated that about one-half of his 60 employees are graduates from trade schools and that graduates are

much to be preferred over shop-trained apprentices. A school training, he said, is most needed in work on the escapements, the setting or planting (*plantage*), and in finishing and regulating.

One of the national schools of watchmaking is located at Cluses. The manufacturer said that all his foremen and many of his workmen had attended this school. He had also placed his sons there. He believes it would be a long and tedious task to train in the shop workmen having the same general knowledge as the graduates of that school.

He regrets that there is no evening school in the neighborhood, as he thinks even the better workmen could derive benefit from an evening course.

The chief advantage of trade schools, he thinks, is the general, substantial, and extensive instruction they give to young men. Practical instruction in them is given in a more scientific manner than in factories and shops. In the schools young men receive an all-round training in their trades, and can afterwards specialize to suit their tastes.

He believes in the extension of trade schools and that they should be of two classes, corresponding to the secondary and superior grades of instruction in France. The former grade should give a very practical instruction and turn out practical workmen. The latter grade should be for the brighter pupils, and should train them as foremen, designers, and engineers.

ATTITUDE OF GRADUATES OF TRADE AND TECHNICAL SCHOOLS.

BARBERS AND HAIRDRESSERS.

Eight barbers and hairdressers stated that they had been to continuation schools. One had attended the school at Montpellier, and the other seven had attended the evening courses maintained by the barbers' union, under the general direction of the labor exchange at Marseille. At the latter school great attention is paid to teaching ladies' hairdressing. This branch of the trade, it was stated, is at present hardly ever taught to apprentices in the shops, for the reason that customers will not consent to be served by apprentices if they can avoid it. Several stated that if it were not for the school there would be no ladies' hairdressers. All employees who had been to the Marseille continuation school claimed that in this branch of the trade the school training had replaced apprenticeship in the shop. Several claim that the school training altogether replaced shop apprenticeship in their cases. It is the unanimous opinion of the eight employees that their school training has made it easier for them to find employment, and that they occupy better positions as a result of it. They also earn more wages than if they had not been to the schools. One man worded his statement as follows: "A graduate who has any equipment whatever is more easily placed than another would be.

The diploma gives the workman a value in the eyes of the employer, and it permits him to advance more rapidly."

It is the general opinion that a trade-school training is a better method than shop apprenticeship. This statement must, however, be taken to refer more particularly to ladies' hairdressing in the case of the graduates of the school at Marseille. The employee who had attended the Montpellier school believes it is better to learn the trade in a day school than in a shop, but the next best plan is to combine work in a shop with the evening courses. This is virtually what is done by nearly all students in so far as most branches of the trade are concerned.

BLACKSMITHS.

Two blacksmiths, both of whom are graduates of the Municipal Diderot School at Paris, stated that their school training had enabled them to secure employment more readily and to obtain better positions than if they had not possessed that training. One said the school training replaced a shop apprenticeship in his case. The other believes that a person in order to become a good workman needs much more practice than can be given in a school. On leaving school he lacked the practical training and quickness that are necessary in a shop.

Neither had found any difference in the wages paid to shop-trained men and graduates of trade schools. Both believe it is more advantageous to attend a genuine trade school than to combine shopwork and attendance in an evening school. As a reason for so believing one stated that in the trade school proper the foremen are selected from the highest class of workmen, and teach the pupils better and easier methods of doing their work; also that in the school the theory which is to be so useful in the future is indelibly stamped on the pupil's memory.

CABINETMAKERS.

Statements were received from two cabinetmakers who were trained in the Eastern Railway Company's apprenticeship school at Mohon. In their opinion it is more advantageous to go to the trade school than to enter directly into the shops and attend a night school. In the school at Mohon the apprentices receive three years of theoretical and practical instruction, after which they are distributed among their respective shops as "helpers." One cabinetmaker stated that he remained a helper for four years before he was considered a finished workman. The other said it required several years to perfect himself in the work after leaving the school.

CLERKS, PAPER AND PAPER GOODS.

Ten persons who occupy positions as clerks in paper manufactories, etc., returned statements. These employees were graduated from the

school for paper and paper goods making at Paris. This is a continuation school; hence the instruction it gives can not take the place of an apprenticeship, although it may go hand in hand with it.

The school may be attended by those who have completed the usual term of workshop apprenticeship, but who wish supplementary instruction. Several who attended the school during their term of apprenticeship said the instruction there given reduced the time required to learn the trade. One stated that a four years' course in the school is equivalent to two years of shop apprenticeship. They all claim that the school training has made it easier to obtain employment, and better places, etc. This latter statement is partly borne out by one of the proprietors, who states that most apprentices wish to become office clerks, etc., rather than paper makers after being graduated from the school. Seven clerks say they receive a higher wage as a result of the school training than they would otherwise receive. There is considerable difference of opinion among the employees as to the best method of learning a trade. Three persons believe a combination of shop apprenticeship and attendance on an evening school is the best plan. Two others favor such combination, but think the shop apprenticeship should precede the attendance on the school. Two clerks believe that where possible the student should first attend a trade school. One of these adds, however, that as soon as the student shall have obtained a fair idea of the trade he should enter a factory and attend the evening courses. One clerk claims that the student will spend twice as much time in unraveling difficulties in the shop as he will in the trade school.

Attendance on the evening school, one clerk states, is sometimes very inconvenient to the apprentices, who, fatigued after the day's work, can not follow the courses with attention.

DRAFTSMAN, RAILWAY CAR SHOPS.

A draftsman who was graduated from the national trade school at Armentières said the school training had replaced an apprenticeship in his case. He found employment as a fitter in a construction company's shops at Belfort immediately after being graduated. He believes this was a better position with a higher salary than he could have secured except for the school training, but he had remained too short a time in the employ of that company, as well as in his present position, to form any opinion as to whether advancement is more rapid for a trade-school graduate. He believes it is better for a youth to learn his trade in a school proper than to work in the shop and attend an evening or continuation school, for the reason that he does not believe an evening school can carry programmes that compare with those of the day schools of France.

ENGRAVERS.

Two engravers, of whom one is a graduate of the Estienne school of Paris and the other a graduate of the Germain-Pilon school of Paris, stated that their school training had not entirely replaced a shop apprenticeship, and that it had been necessary to work for some time in the shops to become finished workmen. One man said it is impossible to learn the trade in any establishment or school in four years. One said his school training has enabled him more easily to find positions, to find better positions, and to earn more wages than would have been the case under other circumstances. Both are agreed that their advancement has been more rapid because of their school training, and that the genuine trade school is better for the beginner than the combination of shop apprenticeship and evening courses.

FITTER, AUTOMOBILE FACTORY.

A fitter working in an automobile factory stated that the trade course he had taken in the Montbéliard practical school had taken the place of a shop apprenticeship. He believes it has enabled him to obtain better wages and to advance more rapidly than if he had received only a workshop training. It has also enabled him more readily to obtain employment. Instruction in a trade school proper is better, he said, than a shop apprenticeship combined with evening courses.

FITTERS, CAR BUILDING AND REPAIR SHOPS.

Statements were received from eight fitters employed in the car building and repair shops of the Eastern Railway Company. Five of these men are graduates of the Diderot School at Paris. The other three are graduates of the above-named company's apprenticeship school at Mohon.

In answer to the question whether trade-school training has replaced apprenticeship in the shop, the general reply was "Yes," although several explained that it requires some time longer to become an experienced workman. Nearly all the qualified answers came from graduates of the Diderot School, one of whom stated that three months' shop work are necessary to complete the practical training of the graduate, while another placed the time at two years. A third man said that after graduation it is necessary to spend considerable time in shop work in order to become a good workman.

It should be stated that the railway company does not regard the apprentice as a finished workman upon his leaving the apprenticeship school, for he must afterwards serve a term in the shop as a helper.

None of the three graduates of the company's school made any statement in regard to the effect of a trade-school education, but all the graduates from the Diderot School said it had been of assistance to them in

securing a position. Three of them stated that it had enabled them to secure higher wages and to advance more rapidly than would otherwise have been the case, while one said he had noticed no appreciable difference as between himself and the shop-trained men in these respects.

There was some difference of opinion in regard to the question whether it is better to go to a trade school proper or to combine apprenticeship in the workshops with attendance on the evening schools and courses. Six answered in favor of the trade school, one in favor of the shop training and evening school, while one stated that for theory, drawing, and technical demonstrations the school has the advantage, but for practical experience the shop is better. Some of those who favor the trade school over the shop apprenticeship gave their reasons for their preference as follows: (1) In the workshop the apprentice loses valuable time running errands, and he does not learn the theoretical part of the trade which is so rationally combined with the practical in the school. (2) The apprentice is usually too tired to attend the evening school after the day's work in the shop. (3) Apprenticeship in the workshop entails specialization, so that when the workman leaves one employer it is difficult to find work such as he has been trained to do. One man stated, however, that graduates from the schools can not work fast enough when they enter industrial establishments, and that it requires several months for them to become accustomed to shop methods.

FITTERS, RAILWAY SHOPS.

A fitter in the railway shops at Nantes stated that he had been graduated from the school for apprentices maintained by the industrial society of that city. This is a continuation school which apprentices to members of the society are required to attend while serving their four years' apprenticeship. He said that as a result of his combined shop and school training he earned 45 centimes (9 cents) an hour at the age of 19, but, having accepted a position in the railway service, he had not advanced. Most of his comrades at the school occupy positions as foremen and shop superintendents in private establishments, where there are greater opportunities. He thinks the instruction given in the trade schools at Nantes is too classic. The shop foremen attached to the schools give excellent instruction in principles, but the practical work done in the schools, with the little time devoted to it, does not suffice to prepare pupils for entering industrial establishments as workmen.

FOREMEN, ASSISTANT, CAR BUILDING AND REPAIR SHOPS.

In this occupation reports were received from four persons, three of whom are graduates from the Diderot School at Paris, and one from

the School of Arts and Trades at Aix. Three of these employees stated that their trade-school education had replaced a shop apprenticeship, but the fourth said that several years of shop practice are necessary in order to acquire the practical skill which is lacking in a graduate of a trade school. Another stated that the graduate is a little awkward when he first enters an industrial establishment, but in a short period of time he is farther advanced than the shop-trained youth. All four stated unqualifiedly that as a result of their school training they had found positions more easily, secured better positions, gained higher wages, and had advanced more rapidly than had those not having such an education. All four said it is better to learn a trade in a genuine trade school than to undergo a shop apprenticeship in combination with attendance on an evening school.

FOREMAN, CAR BUILDING AND REPAIR SHOPS.

A foreman in the car building and repair shops of the Eastern Railway Company stated that his experience in the National School of Arts and Trades at Châlons-sur-Marne had been of such character as to replace a shop apprenticeship. As a result of the industrial education he received in the school, he had more readily obtained a position, had earned a higher salary, and had advanced more rapidly than if he had not been graduated from a trade school. He prefers the trade school to the shop apprenticeship combined with evening courses.

FOREMEN, FITTERS, CAR BUILDING AND REPAIR SHOPS.

Two foremen of fitters, employed in the car building and repair shops of the Eastern Railway Company, made very similar statements. One received his trade education in the National School of Arts and Trades at Aix. The other is a graduate of the Diderot School at Paris. Both foremen stated that the school education had replaced a shop apprenticeship. Both occupy better positions, receive higher salaries, and have advanced more rapidly than would have been the case had the trade-school education been absent, although one stated that he had to give proof of his ability before he was employed. Both prefer the genuine trade school to the combination of shop training and attendance on evening courses.

FOREMEN, JOINERS.

Statements were received from two foremen of joiners. One foreman was graduated from the Paris Diderot School. The other was a shop-trained man who had attended the continuation trade school of joinery at No. 5 Rue Girardon, Paris. The former said that the three years' course in a trade school is too short a time in which to produce a practical workman, but experience in an establishment quickly sets matters right. Both foremen stated that they had been benefited in

position, wages, and advancement as a result of the school training they had received. The foreman who was trained in the workshop and the continuation school stated that he prefers that method of learning a trade because the pupil never feels out of place as does a graduate when he first enters the workshop and is compelled to work by the side of the shop-trained men who are not so intelligent as he, but who, nevertheless, have acquired much greater dexterity.

FOREMAN, PAPER MAKERS.

A foreman in a paper making establishment stated that a course in the Continuation Trade School of Paper and Paper Goods Manufacture of Paris had enabled him to better his position and obtain higher wages. He had advanced more rapidly than if he had not attended the school. He believes it is better for a young man to go into a shop to learn a trade, and supplement the practical knowledge there gained by a course in the evening or continuation trade schools. In these schools the apprentice will obtain a more modern and thorough theoretical and practical instruction than workmen can give him in the workshops.

FRAISERS, CAR SHOPS.

A fraiser had attended a trade school at Saumur. At the school he was trained as a turner, but he had to perfect his practical education in a foundry. As a result of his trade-school experience, he had been able to secure a better position and higher wages and had advanced more rapidly than he could otherwise have done.

He believes the trade school offers a better instruction than the workshop combined with the evening school. The teachers in the school devote more time to students and teach them the theory as well as the practice of a trade.

JOINERS.

Statements were received from four joiners. Of these, two were graduated from, and one was still attending, the Continuation Trade School of Joinery at Paris. The continuation school is not intended to teach the trade, but only to improve the knowledge of workmen by teaching them drawing, modeling, etc., and some theory of the trade. All three were of the opinion that the combination of shopwork and evening school is the best way to learn a trade.

One joiner was graduated as a joiner's helper from the apprenticeship school of the Eastern Railway Company, at Mohon. After serving in the army he did not return to the company, but found a position as joiner at good wages. He believes a trade-school training is preferable to a shop apprenticeship.

MACHINE BUILDERS' HELPERS.

A machine builders' helper, who is a graduate of the National Trade School at Vierzon, said his trade-school training had replaced an apprenticeship in the shop, but that it had not enabled him to find a position any more easily, to earn any higher wages, or to advance more rapidly than if he had not been to the school. He stated that trade-school education is, nevertheless, better than a shop apprenticeship combined with an evening course.

MACHINE FITTER.

A machine fitter stated that it took some time for him to become a finished workman in the trade of fitter after he was graduated from the Diderot School at Paris. He had not, as a result of trade-school education, been enabled more readily to obtain employment or a better position. Neither had he received higher wages nor had he advanced more rapidly because of his school training.

He said that, theoretically, the school is preferable to the shop apprenticeship, but on leaving the school the graduate should place himself in a good shop for improvement in the practical work.

PAPER MAKERS.

Statements were received from three paper makers, who had attended the Continuation Trade School for Paper and Paper Goods Manufacture, located at Paris. From the nature of this school it is evident that it can not replace an apprenticeship, but is intended to complement the trade knowledge of those employed in the paper industries and to render easier the learning of the trades by apprentices. One paper maker expressed himself, in regard to the instruction given in the school, as follows: "The school gives the apprentice the theory which he can not acquire in the factory. His shop training makes him only an ordinary workman, but by the help of the knowledge acquired in the continuation school he may later on become a foreman. He may even be able to outline and superintend new classes of work." All three paper makers stated they had received practical benefits in the matter of employment and wages as a result of the instructions received in the school.

PATTERNMAKERS, CAR BUILDING AND REPAIR SHOPS.

Statements were received from three patternmakers, who had been graduated as joiners from the Diderot School at Paris. They returned indirect answers to the question whether the school training had replaced an apprenticeship, but the trend of their replies indicates that they believe a further apprenticeship in the workshop is necessary before a graduate joiner can be considered a good workman.

One man, in fact, stated that about two years spent in shopwork are absolutely necessary to form a good workman of a trade-school graduate. They were unanimously of the opinion, however, that a genuine trade school presents greater advantages to one who wishes to learn a trade than does a shop apprenticeship combined with evening courses. One man said that as a result of the theoretical knowledge acquired in the school he had, beside his original trade of joiner, been able to fill positions as patternmaker, designer, chemist, and cabinetmaker. Another had been employed as joiner, patternmaker, accountant, designer, and machinist.

WATCHMAKERS AND REPAIRERS.

Statements were received from six watchmakers, who had been graduated from the National Watchmaking School of Cluses, and from one who is a graduate of the watchmaking school of Paris. The general opinion of these workmen is that the trade-school training can replace a shop apprenticeship. Five watchmakers said that they had, as a result of their trade-school training, found positions more readily, had found better positions, and had been able to gain better wages and advance more rapidly than would otherwise have been the case. The sixth man had not profited in any of those respects, but he believes that because of the theory and principles there taught it is better to learn the trade in a school than to go directly into the workshop as an apprentice. The five employees of the Cluses district united in saying that most of the foremen and "first workmen" are graduates of trade schools. The factories, they said, generally specialize their apprentices from the beginning. Workmen thus trained suffer from lack of general knowledge, which fact often limits their ability to do original work.

CHAPTER VII.

TRADE AND TECHNICAL EDUCATION IN GERMANY.

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INTRODUCTION.

To determine the progress of trade education in Europe during the last two or three decades one turns to Germany rather than to any other country, because of the great impetus that trade education has there received, and because its development has corresponded with a most remarkable advance of pure scientific knowledge on the one hand and of industry on the other. It is inevitable that some causal connection should be seen between these two conditions. Germany seemed to typify the application of science to industry, and in technical education was found the medium through which this union was consummated.

There are branches of industrial education and particular classes of schools in which Germany is believed to be surpassed by other nations, but no other nation has more fully realized the complexity of the problem of trade education, the varying needs of the different classes of industrial workers, and consequently the great need for a variety of schools and systems of training for meeting these varying demands. This specialization of industrial or technical schools in Germany is the most characteristic feature of the system that has there been developed. In Germany it is always presumed that the young man has determined pretty definitely the career into which he expects to enter and will shape his education accordingly. By this is meant that a selection is made not merely of the industry or trade but also of the grade of employment, whether as a skilled artisan, a foreman or superintendent, or as a general manager or employer.

This selection is made for the double reason that the economic circumstances of the young men will not permit them all to devote the same time to scholastic training, and because the character of the instruction necessary as a preparation for these different positions is radically diverse. The problem in Germany is that of training all classes of industrial workers, from the lowest artisan to the director or owner of the great industrial establishments. There are special schools for the training of employers and managers, for the training of foremen and bosses, and for the trade education of artisans.

In the present report an effort has been made to describe in detail some of the most important or typical schools for the training of foremen and artisans. In addition a brief description of the general scheme of trade and technical education is given in order to show the relation and importance of the part devoted to such instruction.

In the account that follows no attempt has been made to take up all of the German States and describe the systems of trade and technical education existing in each. The type of school has been taken as the unit of classification rather than the State. At the same time care has been taken to point out the particular State or States in which each type finds its best or fullest expression. It should be distinctly understood, however, that there are important differences between the States, both as regards the extent to which provision has been made for trade and technical education and the lines that such action has followed.

Founders of the trade and technical schools are often the communes, guilds, and industrial associations. Especially is this the case in Saxony, Hesse, and Nassau. Where the means of the locality are insufficient, or where, as in the case of the building-trades schools and the industrial-art schools, a national need exists, State schools have been established. Of 251 industrial schools participating in an educational exposition held in 1898 at Dresden, 88 were founded by societies, 48 by the State, and 47 by private individuals. The trade and the industrial continuation schools of Baden are exclusively communal institutions, assisted by the State. Industrial schools of a lower grade are established or maintained by the State only in exceptional cases.

The participation of manufacturers in the conduct of an industrial school is of great value, but difficult to secure unless the school obtains financial assistance from them. It has been found that a demand for assistance from the guilds and others interested incites them to greater efforts in behalf of the schools. Where industrial schools are established and maintained without any sacrifice on the part of the manufacturers, the latter fail to participate properly, and as a result lack confidence in the school.

Prussia usually requires that the community or other bodies or individuals interested in the trade schools shall provide and maintain the quarters and furnishings. In the case of industrial continuation schools they must also furnish heat and light.

The State ordinarily furnishes the school supplies upon the establishment of a trade school. The amount of the State contribution depends mostly upon the capability of the community. It is higher where attendance is compulsory than where it is not. According to a memorial of the ministry of commerce, issued in 1896, 60 trade schools in Prussia obtained 1,428,784 marks ($340,051) from the State

during the school year 1896–97, and 744,797 marks ($177,262) from the communities. Even in the case of the State institutions (schools for the building trades, industrial art, machine construction, etc.) the community either furnishes and maintains the building, besides contributing a fixed amount, or pays a portion of the cost of maintaining the school that is not covered by the State appropriation and other receipts. Of the total cost of the industrial schools of Berlin in 1896–97, with an attendance of 19,120 pupils, the State paid 86,089 marks ($20,489), the city 329,363 marks ($78,389), the guilds 9,115 marks ($2,169), and societies, etc., 12,520 marks ($2,980), making a total of 437,087 marks ($104,027).

In Bavaria the industrial continuation schools are communal institutions, receiving subsidies from the districts and from the State. The trade schools are in part State schools and in part communal or district schools with State subsidies.

In Saxony no regular scheme is followed, but whenever the amount of assistance rendered by communities or interested parties is insufficient the State usually grants subsidies. In Saxony the principle of active participation in the industrial school system on the part of interested parties has reached its highest form.

In Wurttemberg a tuition fee is charged in the industrial continuation schools. The community must furnish the quarters, but whenever new buildings are constructed a contribution is obtained from the State. One-half of the remaining expense of maintenance must be borne by the community, and the other half is paid by the State.

In Baden, since 1892, a division of the expenses has been made among the State, the community, and the institutions. In all trade and technical and industrial continuation schools the community furnishes the quarters, heat, light, and school supplies, and pays a part of the salaries of the teachers. The remainder of the teachers' salaries and the traveling expenses of the teachers are borne by the State. Teachers not on the regular lists are paid solely by the community. In 1899 the communities paid 247,000 marks ($58,786), the State 143,000 marks ($34,034), and other institutions 20,000 marks ($4,760) for the support of industrial schools. In addition the State contributed about 16,000 marks ($3,808) for special practical courses at the larger industrial schools. The government of Baden paid toward the cost of maintaining the industrial continuation schools at least 400 marks ($95.20) per year for each community, or a total of about 40,000 marks ($9,520), and furnished the instruction material prescribed by the industrial school council (*Gewerbeschulrat*).

In Mecklenburg-Schwerin the grand duke decreed in 1836 that industrial continuation schools should be created in all of the (40) cities. The State subsidy for these communal institutions varied from 50 to 150 thalers, according to the population. The industrial

continuation school at Schwerin, on account of its transformation into a model school (*Musteranstalt*) in 1898, was transferred to the jurisdiction of the ministry of the interior.

In Brunswick, in 1896, the three existing commercial continuation schools were converted into institutions of the chamber of commerce, and seven additional schools were established by the latter body. The annual cost of the ten schools was 41,800 marks ($9,948) in 1899. According to the law of June 28, 1851, which is still in force in Brunswick, the State government determines where industrial schools are to be established, what tuitions are to be required, and what assistance the community is to furnish in the form of quarters, heat, light, and furnishings. The balance is paid by the State.

The following is a comparative summary of State expenditures for trade and technical industrial education in recent years:[a]

Prussia, 142,000 marks ($33,796) in 1874; 475,000 marks ($113,050) in 1885; 4,672,000 marks ($1,111,936) in 1899. Saxony, 253,000 marks ($60,214) in 1873; 570,000 marks ($135,660) in 1885; 1,138,000 marks ($270,844) in 1898. Wurttemberg industrial continuation schools, 58,000 marks ($13,804) in 1869; 129,000 marks ($30,702) in 1879; 164,000 marks ($39,032) in 1889; 208,000 marks ($49,504) in 1897.

The cost to the State per capita of the population of these expenditures was as follows: Prussia, 15 pfennigs (3½ cents) in 1899; Saxony, 29 pfennigs (7 cents) in 1898; and Hesse, 22 pfennigs (5 cents) in 1898. The cost per 1,000 marks ($238) of the entire State expenditures was 2.27 marks (54 cents) in Prussia in 1899, and 5.88 marks ($1.40) in Saxony in 1898.

As regards the control and administration of trade and technical schools the most marked tendency in Germany in recent years has been toward centralizing authority in the State governments. Originally the idea was that the establishment and maintenance were duties devolving upon private organizations and the local governments. More and more, however, the State has given its financial aid to the schools. The necessary conditions accompanying such aid were that the State should exercise a voice in determining the programme and conduct of the schools. The result has been that the State is now thoroughly committed to the policy of supporting industrial schools, and has consequently had to provide for governmental machinery for exercising the necessary supervision.

In Prussia there have been frequent changes in the higher administration. In 1879 most of the trade and technical schools were placed under the ministry of education, and in 1885 they were restored to the ministry of commerce and industry. At the request of the

[a] These figures, as well as those preceding, were obtained from an article on "*Gewerblicher Unterricht*" in Conrad's *Handwörterbuch der Staatswissenschaften, 2e Auflage, 1900.*

Prussian Chamber of Deputies a "Permanent Commission for Technical Education" was appointed in 1879, consisting of members of the House of Lords (*Herrenhaus*) and of the Chamber of Deputies, heads of industrial establishments, handicraftsmen, directors of industrial schools, and officials. Up to the year 1900 this commission had met but five times, namely, in 1880, 1881, 1883, 1891, and 1896, on occasions when the Government contemplated important alterations in the industrial educational system.

In Bavaria, since 1872, the entire educational system has been under the ministry of public worship and education.

In Saxony the industrial, mercantile, and agricultural schools have always been under the ministry of the interior.

In Wurttemberg there is (since 1853) a royal commission for the industrial continuation schools under the authority of the ministry of education, consisting of members of the central industrial and commercial bureau (*Centralstelle für Gewerbe und Handel*), whose president is the head of the commission, three higher school officials (*Oberschulbehörden*), and the director of the industrial art school. The weaving and other trade (*Fach*) schools in Wurttemberg are under the ministry of the interior and under the immediate supervision of the above-mentioned central bureau; the building trades school, the industrial art school, and the higher commercial schools are under the ministry of public worship and education.

In Baden there exists (since July 1, 1892) a grand ducal industrial school council (*Gewerbeschulrat*), consisting of four regular and six special members under the immediate jurisdiction of the ministry of education. This council is presided over by a member of the ministry of the interior, and is the central authority over all industrial and commercial schools. Formerly part of the industrial schools were under the ministry of education and part under the ministry of the interior. The Baden industrial educational system is well centralized. The programme for all industrial schools is prescribed by the central authority. The school supplies are largely furnished by the industrial school council, and the books, patterns, and models which are secured by the school authorities at communal expense must be approved by this council.

In Hesse the trade and technical and industrial art schools are under the grand ducal central industrial bureau (*Centralstelle für die Gewerbe*), which is supported by the handicraft school commission (*Handwerkerschul-Kommission*), consisting of eight members of the State industrial society (*Landesgewerbeverein*).

In Prussia the industrial continuation schools in most administrative districts were formerly either not supervised at all or only in a perfunctory manner. A beginning in the way of thorough supervision has been made in some provinces. Several of the administrative

presidents have, since 1899, appointed technical advisers for the industrial schools. In the city of Breslau the supervision of the entire trade and continuation school system was placed under a single director in 1899.

Saxony has had, since 1884, a professional industrial school inspector. He visits annually about 100 schools. The 28 lace-making schools of Saxony have had a special inspector since 1858. The cost of supervision of the industrial schools of Saxony in 1899 was 18,000 marks ($4,284). A government building official has been intrusted since 1894 with the supervision of the building-trades schools. The inspection service since 1894 has been improved in the trade schools for weaving by securing the services of teachers of the higher weaving schools and in the case of other trade schools by making use of professors of State technical institutions.

In Baden since 1892 a special industrial school inspector has been employed, who in 1892 had under his supervision 45 trade and technical and 73 industrial continuation schools. He reports the results of his inspections to the grand ducal industrial school council, and the latter gives the decisions and the necessary orders to the local supervisory authorities. In 1898 the industrial school inspector visited 35 trade and technical and 61 industrial continuation schools.

In Bavaria the industrial continuation schools are under the uniformly organized supervision of the district governments. For the supervision of trade schools in the technical sense, the ministry of public worship and education utilizes the teachers of the technical high school, the industrial art schools, etc.

In Wurttemberg the supervision of the scientific instruction at the industrial continuation schools is in charge of prominent directors and teachers of such schools. The itinerant teacher (*Wanderlehrer*) employed in 1899 is also required to visit these schools and to report to the commission regarding the same. The supervision of instruction in drawing is in the hands of experienced drawing teachers.

In Hesse the handicraft schools (*Handwerkerschulen*) are supervised by the handicraft school commission.

In Germany the fact is realized that the best school organization and the most complete equipment of the trade and technical schools avail nothing if the proper teachers are lacking. In the selection of trade instructors preference is therefore given to skilled and experienced practical men over those whose practical work has been only of a secondary character. Teachers of trade and continuation schools are expected to keep in close touch with the industrial enterprises in their vicinity. In Wurttemberg, for example, candidates for positions as trade and art instructors in industral continuation schools are required to have a long previous experience as actual wage-workers. Practicing architects, superintendents of workshops, and mechanical

engineers, especially those who have had experience abroad, are mostly sought after as instructors in trade drawing and in industrial art.

Special examinations for teachers of industrial schools exist in but a few of the German States. In Bavaria such examinations are held for teachers of languages, mathematics and physics, chemistry and natural history, drawing, machinery and building, commercial science, and agriculture. Nevertheless, preference is often given to persons having had practical experience, regardless of their rank in the examinations.

In Baden, since 1892, teachers in industrial schools are no longer trained in the technical high school, but in a special division for such teachers at the Building Trades School at Carlsruhe. The students in this division are required to work in shops, factories, or at construction plants during the eight weeks' annual vacation. After three and one-half years of theoretical instruction, and upon presenting a certificate showing that they have worked in at least three different trades, they become eligible for the industrial teachers' examination. When appointed as teachers they become State officers and receive a graded salary. The education of these teachers must be supplemented from time to time by attendance at continuation courses, and excursions for study and observation, which are partly paid for by the State. Written reports must be made by the teachers to the State authorities giving the results of their study and observations. Public school teachers who give instruction in the industrial continuation schools must attend courses of from four to five weeks in technical drawing, correspondence, arithmetic, and bookkeeping. The expenses of these courses are borne by the State.

In Prussia, teachers in industrial continuation schools take courses of from four to six weeks in drawing and in commercial branches, the expenses of which are usually borne by the State.

In Hesse, optional courses lasting from two to three months per year are given for teachers of industrial schools. No tuition fees are charged, the expenses being borne by the State industrial society.

CLASSES OF INSTITUTIONS.

In order that a comprehensive idea may be obtained of all the means for trade training in the Empire, and especially that the relations of the groups of institutions with one another may be clearly seen, it is imperative that an attempt be made to classify them in some way. This is a difficult task, as it is often impossible to determine the exact character of an institution, and the same institution may carry on different lines of work, which would seem to entitle it to mention in more than one class. Any scheme of classification will therefore be defective

and the one here presented (a) can not claim to be an exception to the rule. It is believed, however, that it gives an accurate representation of the different kinds of trade and technical schools to be found in the German Empire, and, taken in connection with the accompanying description of the different classes, will probably give a true idea of the character of industrial education as it exists in that country to-day. Following is the classification:

1. Technical colleges.
2. Secondary or intermediate technical schools.
3. Schools and museums of industrial art.
4. Schools for foremen.
5. Schools for the building trades.
6. Schools for the textile trades.
7. Trade and industrial continuation schools.
8. Industrial drawing courses.
9. Other institutions for industrial education.

TECHNICAL COLLEGES.

At the head of the system of technical and industrial education in Germany stand the great universities of science, or the technical colleges (*Technische Hochschulen*). The purpose of these institutions is to give not only the highest possible instruction in the sciences, a task which equally belongs to the universities, but the application of this knowledge to the operations of industry. The schools are in reality engineering schools, and confer the degree of doctor of engineering (*Doktor-Ingenieur*).

At the present time Germany is in possession of nine institutions of this character, the locations of which, with the dates of their foundation, are as follows: Brunswick, 1745; Berlin, 1799; Carlsruhe, 1825; Munich, 1827; Dresden, 1828; Stuttgart, 1829; Darmstadt, 1868; Aix-la-Chapelle, 1870; Hanover, 1879. A tenth school is proposed at Danzig.

Of these schools the one at Berlin, located in the suburb Charlottenburg, is the largest and most important. A brief notice of it will serve as a description for the whole group. To a very large extent the Berlin system is reproduced in the organization of the other institutes.

The origin of the Berlin or Charlottenburg Institute of Technology is found in the old Royal Architectural Academy, which was established as early as 1799. In 1821 there was opened a technical institute which was added to the Architectural Academy. In 1866 the technical institute was changed somewhat in character, and in 1879 the two institu-

a This classification follows to some extent that given in an article on "*Gewerblicher Unterricht*" in Conrad's *Handwörterbuch der Staatswissenschaften, 2e Auflage, 1900.* Free use has also been made of the contents of this article in the general description and history of the different classes of schools.

tions were converted into a true technological institute. The other technical academies of the Empire soon modified their schemes so as to conform to the Berlin type. Concerning them the United States Bureau of Education, in its report for the year 1897–98, in an article on German education (p. 70), says:

> The new universities thus developed have the purpose of affording higher instruction for the technical professions in state and community service, as well as in industrial life, and of cultivating sciences and arts which are intimately connected with the field of technology (Berlin provisory statute, 1879). They prove themselves equal to universities in the following points: They claim for their matriculated students the same preparatory education required by the old universities, namely, nine years at a classical high school; they grant and insist upon perfect freedom in teaching and learning, and are under the direction of rectors elected for one year, instead of having principals chosen for life, as in secondary schools.
>
> The institute is organized in six departments: Architecture, general construction engineering, machine construction, naval engineering, chemistry and mining engineering, and applied science in general.
>
> In the other institutes of technology the departments are generally the same, but in certain schools special attention is devoted to some one subject. Thus the Munich institute has an agricultural branch, and Aix-la-Chapelle gives prominence to mining engineering. Electrotechnics are taught in all the schools in the machine construction department, it being considered that every construction engineer should be thoroughly familiar with electrical machines.

SECONDARY OR INTERMEDIATE TECHNICAL SCHOOLS.

The technical colleges are intended to give instruction of the highest character. In order to enter, therefore, students must have received a thorough preparatory training in an academy or a school of arts and sciences (*Gymnasium oder Realgymnasium*), and they can not graduate before they have attained the age of 24 years. The education here received often exceeds the real needs of many branches of industry. Hence there may result a loss of time which could have been devoted to obtaining practical skill. The matter of expense involved in going through such a school is also of importance. In consequence of these considerations, there was found to be a need for technical schools somewhat less pretentious in their programmes, lower in their requirements, and giving instruction of a character more directly concerned with industrial work. This is the function of the secondary or intermediate technical schools (*gewerbliche Mittelschulen*).

In considering the value of this class of schools, it is of interest to note the testimony of the Association of German Engineers, an organization having over 14,000 members. According to Director Peters, of this association, while there is a surfeit of engineers of the grade

turned out by the technical high schools, engineers of a lower grade and technical experts who are fitted for the positions of machine constructors, mechanical engineers, chemists, superintendents of departments, building experts, etc., are needed. Thus, of 3,281 engineers employed in 105 of the most prominent German industrial firms, only 1,124, or 34 per cent, were from technical high schools, while 2,157, or 66 per cent, had attended the intermediate technical schools.

The oldest intermediate technical school of this class in Germany is that at Chemnitz, founded by the Royal Saxon Government in 1836. This school has served as the model for a great many other schools, and in particular was copied by Austria in the organization of her system of industrial schools. The students who are admitted here have usually served the required one year of military service, and have had some previous experience. The course of study in the Chemnitz school covers seven half years in the departments of mechanics, chemistry, and construction, and eight half years in the department of electro-technics.

In the whole of Germany there are now twenty-four schools belonging to this category. They are differently styled in the several States and vary somewhat in character. In Prussia there are five schools, all of which relate to machinery construction, and are styled superior schools for machinery construction. They are located at Breslau, Cologne, Dortmund, Elberfeld-Barmen, and Hagan, and have a total attendance of about 1,400 students. The establishment of these schools, which are State institutions, dates from 1888. There is also a course of two years at the School of Arts and Sciences at Aix-la-Chapelle.

In Bavaria there are four schools, which are called simply industrial schools (*Industrieschulen*). These are located in Munich, Nuremberg, Augsburg, and Kaiserslautern. They date from 1868. It was expected that graduates of these schools would immediately enter industrial pursuits; these schools have to a large extent, however, served as preparatory schools for the technical colleges. Bavaria also has a superior school for machinery construction and electro-technics (*Höhere Fachschule für Maschinenbau und Electrotechnik*) at Würzburg that belongs to this class.

Saxony has a number of intermediate technical schools. Mention has already been made of the one at Chemnitz. Especial mention should be made of the Technikum at Mittweida, a private institution, founded in 1867, which has an attendance of between 1,400 and 1,500 pupils. Another private school at Zwickau (*Ingenieurschule*), founded in 1897, had 196 pupils. The school at Limbach, founded in 1898, had 145 pupils. That at Hainichen was founded in 1900. Many other States have such a school. These are the Higher Technical Institute at Köthen, Anhalt; the Technikum at Ilmenau, Saxe-Weimar-Eisenach; the Technikum at Altenburg; the Technikum at Bingen; the

Engineering School at Mannheim; the Municipal Mechanical Engineering School at Neustadt, Mecklenburg-Schwerin; the Technikum at Strelitz, and the Technikum at Hildburghausen, Meiningen.

Some of these institutions also comprise schools for foremen or for the building trades, but these classes of schools are separately considered.

SCHOOLS AND MUSEUMS OF INDUSTRIAL ART.

The international museums of 1851, 1855, and 1862, in England, Austria, and Germany, respectively, called attention to the fact that, with all their technical excellence, the industrial products of Germany possessed few qualities of artistic finish and design. France showed what could be done in this direction. Her products easily held first rank in this respect, her eminence being the result of centuries of training in this field. Since Colbert's time industrial art education has been emphasized in the training of French workmen, and the accumulated skill and taste due to this training has left its impress on French products. The German States at once set about to remedy their weakness in this respect, and since that time have so persistently established museums and schools for industrial art training that now there is no important city in the Empire which does not possess one or more of these institutions.

The term applied to these schools is art trade schools (*Kunstgewerbeschulen*), indicating that they are primarily industrial or trade schools and secondarily schools in which an effort is made to place the instruction on an artistic level. They occupy the middle ground between the schools of fine arts and the trade schools; their purpose is to apply the principles of art to the trades, to instill artistic sentiments into those engaged in trades and thus raise the standard of taste, and incidentally to bring to the worker the increased remuneration of a higher class of products. This movement began by erecting museums where samples of artistic work could be studied by those interested, while schools for training young persons were also founded in connection with these museums. The Industrial Hall at Carlsruhe was founded in 1865, and was the first museum of this kind in Germany; in 1867 the Industrial Art Museum at Berlin and the National Museum at Munich were established. Other cities also provided liberally for buildings and instruction. Since the founding of these institutions foreign products have been gradually driven from their former controlling position in the German market, and in the last decade Germany has figured as a large exporter of such goods. Tuition fees are always charged in these schools, although a liberal system of scholarships provides for worthy students without means. In most of the schools applicants for admission must show that they have had practical experience in the branch in

which they seek instruction. This relieves the schools from the necessity of giving elementary technical instruction, and permits the instructor to give helpful and advanced work from the very start. It also discourages the attendance of amateurs and keeps the practical side of the work prominent.

As far as could be ascertained, industrial art schools exist in Aix-la-Chapelle, Barmen, Berlin, Breslau, Cassel, Cologne, Dusseldorf, Elberfeld, Frankfort on the Main, Hanau, Hanover, Iserlohn, Königsberg, and Magdeburg, Prussia; Kaiserslautern, Munich, and Nuremberg, Bavaria; Dresden, Leipzig, and Plauen, Saxony; Stuttgart, Wurttemberg; Carlsruhe and Pforzheim, Baden; Mentz and Offenbach, Hesse; Mülhausen and Strasburg, Alsace-Lorraine; Hamburg; Dessau, Anhalt; and Bremen.

Industrial art museums have been established in many parts of Germany. A few of these institutions are described in detail in another place.

SCHOOLS FOR FOREMEN.

While many of the graduates of the intermediate schools that have been described sooner or later become foremen, and these schools therefore are often spoken of as institutions for training foremen, this is not their chief function. They have in view rather the preparation of technical experts of a medium grade. As has already been remarked, Germany recognizes the need of special institutions for each class of workers. In the case of foremen it is felt that the course of instruction should be less technical or scientific and more practical. What is needed, in fact, is a trade school for foremen rather than a technical school.

The government of Saxony was the first of the German States to found a school to meet this special want. In 1855 it established at Chemnitz a school for foremen (*Werkmeisterschule*) in connection with the intermediate technical school already mentioned. The conditions of admission were that candidates should be at least 16 years of age, and have had two years' experience in their trades. The course of instruction was for one and one-half years, with from thirty-five to forty hours' work per week.

In Prussia a great deal of attention has been paid to schools of this class, though here the distinction is not always clearly made between courses for foremen and for high-class machinists. Eleven schools in Prussia have specially in view the training of foremen. These are in Altona, Cologne, Dortmund, Duisburg, Elberfeld-Barmen, Gleiwitz, Görlitz, Hanover, Iserlohn, Magdeburg, and Remscheid. Most of these relate to the industry of machine construction. In the schools of Duisburg and Gleiwitz there are departments for the smelting industry, while the school at Iserlohn relates to the bronze industry.

In Bavaria there are four schools for foremen, called mechanical trade schools (*mechanische Fachschulen*).

In Saxony the school for foremen at Chemnitz, of which mention has been made, prepares foremen of machinists, soap boilers, dyers, and electricians. Since its organization it has instructed about 4,700 pupils. There is a private school for foremen in connection with the Technikum at Mittweida, and since 1896 the industrial school at Leipzig has had a department for foremen.

In Baden there is a school for foremen and machinists at Mannheim that has been in existence since 1897.

In Dessau, Anhalt, a school for foremen of gas works was founded in 1898 by the German Continental Gas Company in connection with the handicraft school of that place.

The city of Hamburg has a school known as the "Technikum," which comprises four divisions, namely: A school for machine construction, a school for steamship machinery construction, a school for shipbuilding, and a school for electro-technics.

There were thus, as far as could be ascertained, 11 schools of this class in Prussia, 4 in Bavaria, 3 in Saxony, 1 in Baden, 1 in Anhalt, and 1 in Hamburg.

The following table shows the occupations of persons who have received instruction at three of the Prussian schools. The tables were prepared on April 10, 1898, for a conference on the Prussian schools which took place at that time. Information for a later date was not available.

OCCUPATIONS OF GRADUATES OF THE SCHOOLS FOR FOREMEN AT DUISBURG, DORTMUND, AND MAGDEBURG.

Occupations.	Duisburg: Graduates from Sept. 29, 1883, to Apr. 10, 1898.	Dortmund: Graduates from Sept. 29, 1892, to Apr. 10, 1898.	Magdeburg: Graduates from Sept. 29, 1893, to Apr. 10, 1898.
Heads of establishments	54	1	1
Other officers of establishments	237	107	11
Machine builders and foremen	39	18	1
Owners of establishments or shops	10	3	.....
Wage-workers	34	9	.....
Draftsmen and technical experts in offices	86	55	83
Assistant chemists	3	.....	.....
Students at other schools	11	1	2
Other than technical work	4	1	.....
Military service	16	23	.....
Deceased	11	.....	.....
Unknown	26	21	5
Total	531	239	103

SCHOOLS FOR THE BUILDING TRADES.

In general, it will be observed, the schools of Germany have been classified according to the grade of instruction given rather than the character of the subjects taught. In the case of two industries—those of the building trades and those of textile manufactures—there

have been developed elaborate systems of special schools. They have been inserted in the classification immediately following schools for foremen, for, as will be seen, much the most important part of their work is the training of young men to take such positions, or the higher ones of superintendents or directors.

Probably the best example of the clear division of technical schools into different grades according to the class of labor they are intended to train, of which mention has repeatedly been made, is found in the schools for the building trades (*Baugewerkschulen*). There are thus three grades of institutions corresponding to the three grades of labor required in building operations. For the first grade, those who have the actual planning of structures and who require thorough and advanced education, there are the great schools of architecture or the special courses in the technological institutes.

For the second grade, those who have actual charge of the execution of the plans of the architects, or who may themselves both plan and execute minor works, there are the building trades schools. These train skilled handicraftsmen as well, but their main function is the preparation of foremen. Finally, in the lowest grade are the evening or continuation schools, to be subsequently described, for the further education of artisans doing actual shop and construction work.

The schools for building trades stand midway between the schools of architecture and these continuation classes. The desirability of special schools for building contractors and managers lies in the fact that for the training of this class of labor a longer period must be given than can be offered in the evening classes. The builders' schools are thus day schools. Probably the essential characteristic of these schools lies in the close union of theory and practice and the fact that the plan of instruction requires that the practice be attained in actual building operations, while the theory is taught in the schools. In contrast with the British schools, therefore, the builders' schools make little effort to have elaborate workshops or to instruct in workshop practice. The idea is not to take any person and fit him to be a builder, but to take persons actually in the building trades and give them the necessary supplementary training fitting them to rise to the rank of foremen or contractors.

The entire arrangement of the courses is made with this idea in view. They are thus divided into terms so arranged that as far as possible they occur during the dull seasons when, on account of the inclemency of the weather, building operations are but slightly prosecuted. It is expected that during the intervals of time occurring between the terms students will return to work, both for the practical training thus to be attained and to enable them to earn the money required to prosecute their studies. There are few schools in other trades where the combination of school and practical work is so

satisfactorily maintained. In a great many of the schools, such, for example, as those in Saxony, Bavaria, and Wurttemberg, this performance of work between the school terms is obligatory, the students not being readmitted until they can prove that this has been done. The conditions of entrance to the schools in the first place also include the requirement that the candidate shall have followed the building trade for a certain length of time. In Bavaria, Wurttemberg, and Baden this time is two years.

These schools have been very successful. The first school was that at Munich, which was established in 1823; a second school, a private institution, was opened at Holzminden, Brunswick, in 1830; and a third, a State institution, in 1837, in Saxony. There are more than fifty such schools in Germany at the present time. In a number of the schools there are departments of civil engineering (*Tiefbauabteilungen*). In these are taught the principles of earthwork construction, water, road, and railway bridge building, canal construction, sewer or water conduit laying, etc.

In Prussia there were in 1890 but nine schools for the building trades, with 1,825 students, while in 1900 there were twenty-one, with over 4,000 pupils. Originally many of these schools were founded under various local auspices; but as in other classes of schools the State has gradually assumed greater and greater control. It has introduced a uniform programme of studies, which is followed in all the schools, even those not directly under its management. This is due to the fact that the State has created a special diploma which is given to graduates. As the possession of this diploma is desired by all the students, the programme of the Government is adopted as best preparing for the examination that has to be passed. Following is the general ground covered by this examination:

Written examination: The elaboration of a proposed structure, with complete plans, specifications, and estimates of cost; eight drawings of details of buildings; two exercises in descriptive geometry; architectural work, especially in iron; ornamentation, as of the façade; mathematics (geometry, algebra, trigonometry); statics; German language.

Oral examination: Building materials, building regulations, accidents, construction courses, etc.

The fee is 80 marks ($19.04) per term. Students unable to pay the fee can be admitted free to the proportion of one-tenth of all the students.

The twenty-one schools for building trades in Prussia are in Aix-la-Chapelle, Berlin, Buxtehude, Breslau, Cassel, Cologne, Deutsch-Krone, Eckernförde, Erfurt, Frankfort on the Oder, Görlitz, Hildesheim, Höxter, Idstein, Kattowitz, Königsberg, Magdeburg, Münster, Nienburg, Posen, and Stettin. Of these, the schools at Berlin, Cologne, and Magdeburg are municipal, and the others are State institutions.

Bavaria has seven schools for the building trades, three of which

are State and four are municipal institutions. Their total attendance in 1899 was over 2,000 pupils. The examinations for graduation are conducted by the State and are uniform. The schools at Munich have also a mechanical department, and the school at Kaiserslautern has an industrial art branch. Other Bavarian building trade schools are located in Nuremberg, Ratisbon, and Würzburg.

Saxony has eight schools for the building trades, located at Chemnitz, Dresden, Grossenhain, Leipzig, Orchatz, Plauen, Rosswein, and Zittau. Of these, five are State, one is municipal, and two are private institutions. The five State schools had an attendance of 771 pupils in 1899. Nearly one-half the time is devoted to drawing. The school at Zittau, which was founded in 1840 as a school for building trades, was reorganized in 1898 by the addition of a school for civil engineering (*Tiefbauschule*).

Wurttemberg has a school for the building trades in Stuttgart, founded in 1845, which had 737 pupils in the winter of 1897–98 and 635 pupils in the summer of 1898. It differs from the other schools of the same name in the fact that combined with it there are courses in machine construction and agriculture. There are thus three distinct departments, each offering instruction of from three to five terms. It also gives open courses in drawing for carpenters and other artisans in the building trades, besides giving special courses in drawing to persons preparing themselves to become teachers in the lower trade schools.

Baden has a school at Carlsruhe with an attendance in 1899 of 470 pupils. It has departments for mechanical engineers, and building, underground, and road construction experts, State overseers, and teachers in industrial schools. In 1899 a department for electricians was instituted. Practical training in workshops for masons and carpenters is also given.

Hesse has had a school for the building trades since 1876. The attendance in 1899 was 126 pupils. It gives instruction summer and winter.

Saxe-Weimar-Eisenach has a State school for the building trades which was founded in Weimar in 1859, and a private school at Stadt-Sulza. Instruction in the former is given only in winter. The attendance in 1899 was 106 pupils.

Mecklenburg-Schwerin has municipal schools for the building trades and for road masters at Neustadt and Sternberg.

Mecklenburg-Strelitz has a school for the building trades at Strelitz.

Oldenburg has a school for the building trades and machine construction at Varel, which is a private institution subsidized by the State.

Brunswick has a school for the building trades at Holzminden, which was founded as a private institution, in 1830, but later became a municipal school.

Saxe-Coburg-Gotha has a school for the building trades at Coburg, founded in 1852, giving winter instruction only, and one at Gotha. The latter had an attendance of 13 in the summer of 1898 and of 116 in the winter of 1898–99. A handicraft school is attached to the latter.

Anhalt has a private school for the building trades at Zerbst with an attendance of 36 pupils in the summer of 1898 and of 183 in the winter of 1898–99. It has departments also for water conduit and underground construction, stone masonry, carpentry, and tile work.

Schwarzburg-Sondershausen has a private school for building trade experts at Arnstadt, with summer and winter instruction. It also has a division for railway construction experts, for road masters, and for street and underground construction work.

Reuss-Schleitz has a private school for the building trades at Gera with summer and winter instruction.

Lübeck has a State school for the building trades.

Hamburg has had a State school for the building trades since 1865. The attendance was 45 in the summer of 1898 and 256 in the winter of 1898–99.

SCHOOLS FOR THE TEXTILE TRADES.

There are few, if any, of the factory industries in which a greater and more successful application of technical school training has been made than in the textile trades. In the attempt to prepare young men for the various positions in this industry Germany was the pioneer, and its schools hold high rank.

The textile schools of Germany may be divided into several classes, according to the character of the instruction they give and the classes of labor for which they are intended. There are: (1) The superior weaving schools (*Höhere Webschulen*); (2) the secondary weaving schools (*Webschulen*); (3) the apprenticeship shops for weaving and knitting (*Webereilehrwerkstätten*, *Wirklehrlingsschulen*, etc.), and (4) itinerant instructors (*Wanderlehrer*). Here again is presented an illustration of the extent to which the instruction is specialized according to the class of labor it is intended to reach. There are thus distinct schools or courses for employers and managers, overseers, designers, agents, and workmen proper.

The superior textile schools of Germany are usually known as weaving schools, since the chief instruction is given in that branch of the industry. In a number of cases, however, as will be seen, there have been established dyeing and finishing departments in connection with the weaving schools. All of the Prussian higher textile schools are under the direct control of the Government and are managed on similar lines. Prussia has eight schools of this grade which are located at Aix-la-Chapelle, Barmen, Berlin, Crefeld, Cottbus, Mülheim-am-Rhein, München-Gladbach, and Sorau.

Though under direct State management at the present time, these schools are of various origins. The school of Mülheim-am-Rhein is the oldest, its foundation dating back to 1849. It is still doing excellent work, though its equipment is surpassed by several of the newer institutions. The founding of the Berlin school was due to the initiative of the guild of weavers of that city. Most of the textile schools in Prussia, however, as well as in the other German States, have been established by the joint action of the local authorities and the central Government. Whatever their origin, they are now State institutions, and the teachers of the Prussian schools are Government officials. The school in each case is placed under the charge of a director, who is assisted in his work by a committee of local manufacturers, bankers, and officers of educational institutions.

In the cooperation between the State and the local authorities the general principle was that the latter should furnish the quarters and the State the equipment, while the operating expenses should be borne equally. In practice, however, it is usual for the State to give much more than its proportion.

Though the schools are general textile schools, instruction is specialized along the lines of that branch of the industry which is most followed in the locality of the school. Thus, the Aix-la-Chapelle, Berlin, and Cottbus schools relate chiefly to wool; Mülheim-am-Rhein and Sorau to linen, jute, and cotton; and the Crefeld school to silk and velvets. In each school the duration of studies is proportionate to the difficulties of the branch of industry taught. In no case, however, is the course more than two years, if the instruction is given during the daytime.

While the higher textile schools are for the training of employers, directors, and specialists, such as designers, dyers, etc., the ordinary weaving schools are primarily for the training of overseers. Of these there is a large number scattered throughout the Empire. They constitute probably the most numerous class of trade schools. They have existed since 1830 in Saxony, 1854 in Bavaria, and 1855 in Wurttemberg. They are reported to have rendered valuable services at times when changes of fashion required new styles of fabrics, when through the introduction of power looms the handlooms had to be resorted to for fabrics which could not be produced on power looms, etc.

The third class of institutions are the weaving workshops, or apprenticeship workshops, as they are sometimes called. These are for the training of ordinary wage workers. They are of especial value for the training of the handloom weavers, a class that is still important in Germany.

The most interesting, and in many respects the most successful, form of trade instruction in the textile industry is that of the system of itinerant instructors. This giving of instruction in weaving by teachers who travel about, going from one village to another, and

actually visiting the homes of the workers, is an exceedingly interesting example of the adaptation of the character and method of trade education to the needs of the people for whom it is intended. As is well known, the factories have not entirely driven out household production, and hand weaving in the homes of workmen still continues in parts of Germany, notably in Silesia. For many reasons it is desirable that the people in the more remote quarters of the Prussian Kingdom should have work of this character which they can do. The Government has sought to preserve the industry as far as possible, and as one of the chief means for doing so has developed the system of giving instruction to domestic workers in their homes. A master weaver possessing the necessary qualifications travels from place to place where domestic weaving is practiced and examines the methods of work followed and the character of the finished product. He gives advice, accompanied by the necessary instruction, concerning the ways in which improvements can be made, what better machines there are, how they can be effectively run, the most desirable raw material and where it can be obtained, new and better designs, what goods are in favor and can find the best market, etc. In Wurttemberg such courses were introduced in order to teach the manufacture of finer and more difficult work on handlooms, and thus to relieve the distress occasioned by the factory system. The official reports speak enthusiastically of the good results accomplished by this system of instruction.

A detailed description of the textile schools at Aix-la-Chapelle, Berlin, and Crefeld, Prussia, and Reutlingen, Wurttemberg, which will be found elsewhere, will give a fair idea of the organization of these institutions.

As far as could be ascertained, there were in 1899 in Prussia 8 superior textile schools, 8 secondary weaving schools, and 22 primary weaving schools, 6 of the latter being in Silesia; in Bavaria, 3 weaving schools; in Saxony, 27 trade schools for weaving, knitting, and trimming making, of which only 6 were day schools; in Wurttemberg there were 3 schools for weaving, 1 for spinning, weaving, and knitting, and 2 primary weaving schools; in Alsace-Lorraine, 1 spinning and weaving school; in Saxe-Weimar-Eisenach, 1 primary knitting school; and in Hesse, Reuss-Schleitz and Reuss-Greitz, 1 weaving school each.

TRADE AND INDUSTRIAL CONTINUATION SCHOOLS.

As has already been mentioned, one of the excellent features of the German system of industrial education is the appreciation of the varying needs of the different classes of the industrial population and the creation of special institutions to meet these needs. Thus in addition to the classes described, there are trade schools proper, trade continuation schools, industrial continuation schools, special trade courses for

master workmen and journeymen, itinerant courses, industrial drawing courses, etc.

As regards the trade schools proper—that is, those which give all day instruction in both practical and theoretical branches and which replace the regular apprenticeships in private workshops—not much need be said in this place, because they form but a small proportion of the agencies adopted for trade education in Germany. The German idea of trade training for ordinary skilled workingmen seems to favor the private-shop apprenticeship supplemented by evening and Sunday instruction at a continuation school. In fact, so little importance seems to be attached to trade schools proper that in the classification of industrial schools they are usually considered together with trade continuation schools, the term "trade school" (*Fachschule*) being often used for either class. In a certain way, therefore, the keystone to the whole scheme of industrial education as offered to the laboring classes proper is found in the system of continuation schools (*Fortbildungsschulen*) which exists throughout the Empire.

Primary education in Germany—that is, the education of children up to their fourteenth year—is compulsory. It is realized that for the great majority of the laboring classes it is necessary that the children above this age should begin work and contribute their share toward the income of the family. Germany has accordingly developed a plan of instruction in her continuation schools to meet this special case of continuing the instruction of young people after they are forced to enter the shops.

The schools are intended for students between the ages of 14 and 18 years, and the courses are held on week-day evenings and Sunday mornings. Originally these schools were what their name implies—institutions in which the general education of the people could be continued beyond that of their primary instruction. As the schools were exclusively intended for the working classes, however, the character of the instruction was more and more made to conform to the practical needs of those receiving it. Although the instruction given was made to relate to matters of a general technical or industrial character, each school so framed its programme of courses as to make them apply specially to the prevailing trades of the locality in which it was situated. The schools were thus in many instances transformed, first from schools of ordinary instruction to those for general technical or industrial education and then to trade schools.

This of course is true only of the continuation schools located in industrial centers. In other localities the schools have either retained their character as schools of general instruction or have become commercial or even agricultural schools in the sense that special attention is paid to matters affecting these branches of work.

This, then, is the first and most important feature of the scheme of

trade education of the working classes, the existence of a system of evening and Sunday schools in which the young workingmen, or the more mature, if they desire it, can receive, while actually employed, a training in matters bearing directly upon the work in which they are engaged.

It is evident that in schools of this character there is no necessity for the possession of workshops or for instruction in the practical manipulation of tools. The instruction is therefore almost wholly theoretical and can be given for the most part in schoolrooms made use of during the daytime for other purposes. It is held that all the practical instruction needed is obtained in the most effective way by the work actually performed in the shops where the workingmen are employed. While the continuation schools thus in many cases give instruction in respect to particular trades, they make no pretense of completely preparing students for the same. Their purpose is to give to the young shop employees the instruction useful to them in their work, but which they can not obtain so well, or at all, in the shops. They thus supplement rather than replace the shop as a means of trade training. In them we have the correlation of school training and shop practice. At the same time this result is obtained with the greatest possible economy. Not only is it unnecessary that the schools should be in possession of costly laboratories and shops, which are equally expensive to keep up, but the students themselves are able to be productively employed during the course of their instruction.

Concerning their value it may be of interest to quote from a report of Consul Monaghan of Chemnitz. Speaking, in 1898, of these institutions in Saxony he says in part:

The supplementary schools are for the people who have to work, what Chautauquas, summer schools, and university extension courses are for others. * * * Parties in politico-economic circles here found that the system of common-school education under which boys and girls were given an ordinary education in reading, writing, arithmetic, etc., up to their fourteenth year, was inadequate, partially if not wholly, to the ends aimed at in such a system. To supply this defect it was urged, and finally proposed and favorably acted upon, that graduates of the common schools, boys especially, in some few cases girls, too, should continue to get instruction a certain number of hours a week. This was made compulsory. Manufacturers, shopkeepers, and mechanics in whose employ such boys were found, and not the parents, were made responsible for the boys' attendance. In these schools, as indicated in the foregoing, the boys get as good an idea as possible of the trade or branch of business in which they are employed. As a rule the hours of attendance are early in the morning or a certain number of afternoons in the week. Sunday mornings are not thought too sacred for this work. It seems to be an acknowledgment that the years hitherto given to a boy in which to get an education, viz, from his sixth to his fourteenth year, are not enough to prepare him for the struggle for life that he has to enter upon. Men have told me,

successful merchants and agents here, that they owe more to the hours spent in the developing or supplementary schools, from the practical character of the instruction given and the information imparted, than to the many years spent in the common schools. While one is hardly willing to believe this, there can be no doubt of the good work done and being done by the schools referred to.

Germany has not been content to see such an important matter as the development of secondary and trade education depend wholly upon local action or private initiative. Radical action has therefore been taken by a number of the German States, such as Saxony, Bavaria, Baden, Hesse, etc., of making attendance upon such schools obligatory upon factory and mill employees between the ages of 14 and 18 years. The Imperial Government has not been prepared to make such obligation general for the whole Empire, but it has provided by law that employers must always permit their employees to attend such schools if they desire to do so, and that the States of the Empire, or, in their failure to act, the local governments, can introduce such obligation.

Thus, as regards general education, an imperial law provides that attendance upon a school shall be obligatory upon all children between the ages of 6 and 14 years. Beyond this the imperial law regarding education does not go. In the gradual development of an industrial code, however, the necessity was early seen of making provision by which industrial workers between the ages of 14 and 18 years should have an opportunity of completing their education. This was a question, however, which it was believed should be left to the individual States, to be decided in accordance with their particular needs and circumstances. The industrial code of July 21, 1869, thus contained an article which authorized the local authorities to make attendance upon a school compulsory for all industrial employees under 18 years of age if these authorities desired to do so. It is a matter of no little interest to notice that this subject of secondary education is considered essentially as an industrial question, to be dealt with in the industrial rather than the educational code.

This principle of local option as regards compulsory attendance upon continuation schools has been retained and extended in subsequent legislation. Where the States do not provide for such compulsory education the local subdivisions can make such provision. The principle can also be extended to young persons employed in commercial establishments. Further, and most important, when such attendance is not made compulsory by act of the State or commune, the employers must always permit their employees under 18 years of age to attend such schools when they desire to do so.

Following is a translation of the sections of the Imperial industrial code of 1891, the law now in force, in regard to this matter:

Employers are required to give the necessary time, to be determined eventually by the competent authorities, to their workingmen under

18 years of age who attend an educational establishment recognized by the communal administration or by the State as an adults' school. Instruction shall not be given on Sunday except where the hours are so fixed that the pupils are not prevented from attending the principal religious exercise or a religious exercise of their faith specially conducted for them with the consent of the ecclesiastical authorities. The central administration may, until October 1, 1894, accord exemptions from this last provision to adult schools already in existence, attendance upon which is not obligatory.

For purposes of this law schools giving instruction in manual work and domestic duties to women shall be considered as adult schools.

By regulation of a commune or a superior local authority male workers under 18 years of age may be required to attend an adult school in so far as such attendance is not already required by the law of the State. The same regulation can establish the provisions regarding this obligation. In particular, decrees may be issued for insuring regular attendance upon the school on the part of those to whom the obligation applies; the performance of the duties incumbent upon parents, guardians, and employers; the maintenance of order in the adult schools and the fixing of the dues to be paid by the students. There are exempted from the obligation to attend an adults' school as imposed by local authorities, those who attend a trade school, whether organized by a guild or not, in so far as the instruction given by the school is recognized by the superior authorities as taking the place of the general instruction given in the adults' school.

Other sections of the law provide that the foregoing provisions apply to journeymen and apprentices employed in commercial establishments; that the regulations made by the local authorities must be issued only after the employers and workingmen interested have been heard; that these orders must be approved by the superior administrative authorities and published in the usual way; that the central administration may annul regulations which are in contravention of laws or regulations issued by higher authorities; and that violations of the laws or orders may be punished by fines.

In pursuance of the power left to the individual States of the Empire, all of the more important ones, with the exception of Prussia, have made such attendance upon adult or continuation schools compulsory on the part of workers under 18 years of age in industrial establishments. In Prussia it is claimed that organization is easier and progress more rapid when attendance upon schools is optional; that under the latter régime the students follow the courses with a great deal more interest than under the compulsory system, and that often they continue their attendance after they are over 18 years of age. Nevertheless, about two-thirds of the industrial continuation schools of Prussia have compulsory attendance through the action of local authorities.

The continuation school takes into consideration the fact that as in a great many occupations the prime requisite is manual skill, it is not necessary that all employees in factories and mills should have a

special training. At the same time it is desirable that all employees should have a certain general education that will permit them to understand the nature of the operations upon which they are engaged. It is to this class of labor that the general industrial continuation schools chiefly address themselves.

A feature of the German system of industrial education is the extent to which instruction is given on Sunday. Mr. Pyfferoen in his official report to the Belgian Government says: [a]

The existence of Sunday schools meets a veritable need. During the week the workingman has but little opportunity to educate himself. Detained all the day in the shop, he has need of rest in the evening. Especially when the programme of the school is somewhat complicated, when the student has eight or ten hours of courses to follow each week in addition to his day's labor, it becomes extremely difficult or even impossible for him to find the necessary time during the workdays. Afternoon courses can, to be sure, be created, but voluntary attendance upon them is an ideal far from realization.

The employers also would consent very unwillingly to this arrangement, which might disorganize the work in their shops; and the workingmen probably would not consent to a sacrifice of their wages during the time of their attendance upon the school. The school would therefore remain deserted.

The law regarding attendance upon an adult or continuation school, it will be remembered, provides that when instruction is given on Sunday it must not prevent the students from attending the principal divine service, or one specially organized for their benefit with the consent of the ecclesiastical authorities. In practice it depends upon the latter authorities to take action in respect to the organization of special services so that morning schools can be held on Sunday. This, which the Catholic clergy have largely done, the Protestant clergy, for the most part, have refused to do. Propositions have repeatedly been made in the Reichstag to have the law so modified as to permit schools on Sunday mornings for adults generally, but they have always been rejected, though they were supported by the Government.

It is important to note, however, that this restriction regarding Sunday courses applies only to so-called adult or continuation schools, and does not apply to trade schools strictly speaking; that is, schools preparing for particular occupations. This, however, does not help the large class of workers who are learning their trades in the shops and who desire only the supplementary instruction which is afforded in the continuation schools or the general courses of the adults' schools.

There is no possibility of obviating the difficulty resulting from the law by holding the courses on Sunday afternoon, as it is universally considered that this time should be completely devoted to purposes of recreation and rest.

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[a] Rapport sur l'enseignement professionnel en Allemagne, par Oscar Pyfferoen, 1897.

The situation of affairs with regard to Sunday instruction at the present time is thus as follows: Sunday mornings are now utilized to a very considerable extent for the holding of courses of instruction for persons compelled to work during the week days. This, however, is not done to the extent desired by many, owing to the refusal of the clergy in many instances to provide special services for the students. There is thus a demand for the repeal of the law requiring such action on the part of the church.

The trade continuation and trade schools in the German Empire, exclusive of those already classified, may be grouped into five classes, namely, (1) general continuation schools (*Allgemeine Fortbildungsschulen*); (2) industrial continuation schools (*Gewerbliche Fortbildungsschulen*); (3) trade continuation and trade schools (*Fachschulen*); (4) commercial schools (*Handelsschulen*); (5) agricultural schools. Only two of these classes come within the scope of this report. These are the industrial continuation schools and the trade continuation and trade schools.

The industrial continuation schools give instruction of a general character, but especially in drawing, bookkeeping, and such other branches as are likely to be of greatest use to persons engaged in industrial or factory occupations. The industrial continuation schools for girls teach in addition to these branches such general work as is peculiar to women, namely, embroidery, cutting, sewing, ironing, millinery, etc.

The trade continuation and trade schools for either sex differ from the preceding in that the instruction is more technical and is specialized, usually for single handicraft trades. The guild schools, which perform such an important part in the German trade education, come within this latter class of schools. The programme of instruction in these schools usually embraces two distinct parts—the general and the technical. The general course includes the study of German, accounts as applied to practical business operations, business correspondence, the use of the metric system, elements of geometry, etc. The technical course varies with the trade to which the school relates and includes trade drawing, mechanics, general principles of the trade, and, in some cases, shopwork.

The following table, taken from a private source, gives some idea of the extent to which trade continuation and trade schools have been developed in the German Empire:

CONTINUATION OR SUPPLEMENTARY SCHOOLS IN THE GERMAN EMPIRE

[Compiled from Pache's Handbook of 1899, part 4.]

State.	Population.	General continuation schools.		Industrial continuation schools.				Trade continuation and trade schools.			
				For males.		For females.		For males.		For females.	
		Number.	Students.	Number.	Students.	Number.	Students.	Number.	Students.	Number.	Students.
Prussia	31,855,123	1	5,000	1,320	145,672	26	4,011	97	8,625	123	10,392
Bavaria	5,818,544	14	734	238	27,299	32	2,816	51	8,687	25	1,947
Saxony	3,783,014	1,943	76,994	39	10,660	7	1,596	112	10,119	18	2,445
Wurttemberg	2,080,898	2,079	31,176	169	15,592	2,093	51,087	6	1,070	37	2,929
Baden	1,725,470	1,591	25,649	106	8,390	(a)	16,717	12	1,099	154	6,894
Hesse	1,039,388	905	25,268	81	8,322	2	116	6	654	4	184
Hamburg	681,632	.....	.....	4	2,319	.....	.....	11	1,224	1	480
Mecklenburg-Schwerin	596,883	.....	.....	45	3,260	.....	.....	1	620	2	40
Brunswick	433,906	1	250	11	1,734	1	139	2	261	2	178
Oldenburg	373,662	1	50	8	480	.....	.....	6	290	1	20
Saxe-Weimar-Eisenach	338,887	452	5,152	10	1,552	2	46	7	332	.....	.....
Anhalt	293,123	.....	.....	17	1,393	.....	.....	1	10	.....	.....
Saxe-Meiningen-Hildburghausen	233,972	298	4,199	1	200	14	204	2	67	2	47
Saxe-Coburg-Gotha	216,624	152	3,720	3	368	3	317	3	256	.....	.....
Bremen	196,278	.....	.....	4	1,669	.....	.....	4	110	.....	.....
Saxe-Altenburg	180,012	11	482	5	350	1	15	1	126	.....	.....
Lippe	134,617	.....	.....	6	722	.....	.....	.....	.....	.....	.....
Reuss-Schleitz	131,469	1	294	2	406	1	174	4	413	.....	.....
Mecklenburg-Strelitz	101,513	.....	.....	9	711	.....	.....	1	736	.....	.....
Schwarzburg-Rudolstadt	88,590	12	463	2	130	1	20	3	138	.....	.....
Lübeck	83,324	1	23	1	1,180	.....	.....	1	33	.....	.....
Schwarzburg-Sondershausen	78,248	92	1,199	6	264	.....	.....	1	40	.....	.....
Reuss-Greitz	67,454	.....	.....	1	350	.....	.....	.....	.....	.....	.....
Waldeck	57,782	119	1,094	2	75	.....	.....	.....	.....	.....	.....
Schaumburg-Lippe	41,244	2	65	.....	.....	.....	.....	.....	.....	.....	.....

(a) Not reported.

The general continuation schools shown in the above table are not industrial or trade schools. They are given only to show the relation between the number and attendance of such schools and those of an industrial or trade character.

On account of the large number of industrial and trade continuation schools in the German States it is impracticable to attempt to give a list of them. A detailed description of some typical trade continuation and trade schools is given in another place.

INDUSTRIAL DRAWING COURSES.

The idea of the German courses of instruction in drawing is to produce men who can both draw and execute rather than those who can only do the former. Mr. Buyse in his report to the Belgian Government (a) expresses himself as follows:

The instruction in all the schools is essentially practical. These schools do not give, as in our [the Belgian] schools, merely the con-

a "Étude sur les écoles techniques," etc., 1898, p. 4.

ventional instruction. They do not limit themselves to the theoretical study of independent technical forms as do many of our drawing schools. They take their inspiration directly from industrial operations or certain trades and get their models from this source. From the humblest guild school to the superior school of industrial art all keep steadily in view the industrial feature. * * * The workman who makes the great sacrifice of devoting two hours to a school after a fatiguing day of toil desires to enjoy as soon as possible the fruits of his studies and advance a degree in the hierarchy of labor. This is why from the start he should find models relating directly to his trade. Then he will be interested in his school because he sees the relation between his studies and his work. The trade, not only in the former but in its technique should constitute the basis for the studies of artisans. That is the German system. The cabinet or furniture maker should draw parts of furniture which he analyzes. * * * Never at any time should the technical practical part of the trade be lost sight of. * * * It is to the diffusion of trade education in relation to artistic education that Germany owes the excellence of its technical organization and industrial equipment and the taste which is more and more characterizing its products.

One of the measures taken to stimulate and assist instruction in this branch is the establishment of the "open drawing hall," a room where there are accommodations for those desiring practice in drawing. A supply of good models is on hand, and a competent instructor assists those who come to work there. It especially gives opportunities to acquire skill in drawing, but it also affords artisans, manufacturers, and others the opportunity to secure good patterns for use in their business. It also strengthens the relations between the technical school and the industry which it is desired to advance.

Open drawing halls have been established in Prussia, Bavaria, Saxony, Wurttemberg, and Hesse, usually in connection with industrial or trade continuation schools.

OTHER INSTITUTIONS FOR INDUSTRIAL EDUCATION.

In addition to the various classes of industrial educational institutions enumerated, there are some institutions which can not be included in these classes and which merit mention in this report. These are apprenticeship shops, practice courses for master workmen, itinerant courses, museums and experiment stations, and school exhibitions.

Apprenticeship shops (*Lehrwerkstätten*) are connected with many of the trade schools, and some are separately maintained. The training given at these shops is about the same that is usually given apprentices in private establishments, except that it is intended to be more comprehensive and systematic. There is much conflict of opinion regarding the utility of these shops, some persons considering them very valuable and others regarding them as shops for amateurs. Those of the latter opinion claim that itinerant instruction is better

and cheaper. It is claimed that instructors at these apprenticeship shops are often poorly paid and are therefore apt to set pupils at work to produce material which can be sold at a profit but which offers little opportunity for thorough training. The shops are therefore criticised by the pupils on account of the one-sided character of the instruction, and by the manufacturers on account of their unjust competition. Apprenticeship shops are frequently found in connection with State railway shops. In Baden, since 1889, the apprenticeship shops have not been conducted by the State, but merely receive State aid. One or more apprentices are placed under the care of a thorough master workman who furnishes them with board and lodging. For this service he receives from the State about 232 marks ($55.22) for each apprentice. The master workman assumes certain obligations to the State with regard to the care and training of his apprentices, and is under the supervision of the local trade guild and the State industrial board. In 1896 the Baden Government appropriated 12,000 marks ($2,856) for this purpose. At the close of that year there were 128 apprentices in 104 apprenticeship shops in 28 different localities in Baden.

Another way in which trade schools are brought into direct contact with the local industries is by the establishment of practice courses for master workmen (*Uebungskurse für Handwerksmeister*), where information is given regarding the most recent progress in the industry concerned. Such courses have been given in Prussia, Baden, and Wurttemberg for cabinetmakers, electricians, jewelers, locksmiths, painters, saddle and harness makers, shoemakers, tailors, tinsmiths, upholsterers, etc.

In addition to those relating to the weaving industry, courses (*Wanderkurse*) are also given by itinerant instructors in bookkeeping, garment cutting, embroidery work, machine sewing, straw plaiting, etc. These courses are usually given in small towns where the cottage industry prevails. They have proved to be very beneficial in Prussia, Bavaria, and Wurttemberg.

Museums and experiment stations are often maintained in connection with trade schools, and serve the purpose of aiding the pupils in their work, besides furnishing models, patterns, and advice, and making tests for industrial establishments in their vicinity.

Much good has resulted from the exhibition of the work of trade-school pupils and of apprentices in different German States. These exhibitions permit a comparison to be made between the various systems of instruction and the practical results as shown in the work accomplished, and also have a stimulating effect upon the pupils whose work is exhibited.

DEVELOPMENT AND SUPERVISION OF THE APPRENTICESHIP SYSTEM.

No comprehensive idea of what is now being done in Germany for the development of trade training can be obtained without a knowledge of the great efforts that are being put forth for the preservation of the apprenticeship system in those trades for which it is adapted.

In Germany as in no other country the people have been unwilling to break with the past. Nowhere else, with the possible exception of Austria, has the contest between the two systems of the handicraft, or production upon a small scale, and the factory, or production upon a large scale, been more bitterly fought. This does not mean that the factory system has been looked upon as an unmixed evil, for it is plainly seen that in certain lines of work its adoption is both inevitable and desirable; but it means rather that in certain other lines of work no effort should be spared to maintain the handicraftsman in his full power and influence.

The attempt to do this, to preserve the handicraftsman and the small trades, is one of the features of the history of labor legislation in Germany during recent years. It has had as its result the formulation of two distinct industrial systems—the handicraft and the factory—and the enactment of labor codes for each. The legislation regarding the factory trades follows in all essential particulars that of other industrial countries. The legislation regarding the handicraft trades is utterly unlike that of England and of the United States, and is closely followed only by the Austrian legislation.

The central feature of this latter system of regulation is the restoration to power and influence of the old guilds, and through them of the apprenticeship system, with all the features of training of boys by masters for whom they are working. The history of this legislation in relation to apprenticeship, the guilds, and the handicrafts generally, has been given in detail in the account of the labor laws of Germany, published by the Department in the Bulletin for March, 1900, therefore only a brief recapitulation is needed here.

During the early years of the nineteenth century the main purpose of the industrial legislation of the German States was the freeing of industry from the many restrictions that had been imposed upon it in the past. In 1845 this legislation culminated in the enactment of a general labor code. In removing many restrictions, however, the effort was also made to bolster up and maintain the old guilds. The reason for this action was chiefly the desire to preserve the apprenticeship system. It was thought that the education of apprentices was a matter that should not be left to the hazard of a purely private contract. At the same time the Government was not ready to introduce a system for the official examination and regulation of apprentices. The law therefore defined anew the duties and rights of guilds

and assigned to them the care of the interests of their trades, the regulation of apprenticeship, and the establishment and maintenance of relief funds for their members. Membership in the guilds, however, continued to be upon the voluntary basis.

In 1867 the Confederation of the North German States was formed. The federal constitution, adopted July 26, gave to the central Government the power to enact general industrial regulations. It was by no means an easy task to frame a law to supplant the diverse laws of the different States. Success, however, was finally achieved, and a general industrial code (*Gewerbeordnung*) was enacted June 21, 1869. After the founding of the German Empire this law was extended by successive acts to those States which were not embraced in the Confederation of the North. The final step was taken in 1889, when its extension to Alsace-Lorraine was practically completed.

In general character this law was similar to the industrial code of 1845. Its provisions, however, were even more liberal, and an industrial system approaching in freedom that of Great Britain was established. As in 1845, however, almost immediately upon the enactment of the code, a reaction set in, and a movement for the modification of its provisions making the right to be an employer, a journeyman, or an apprentice dependent upon certain conditions was started, which, continuing to the present day, has radically modified the system of the legal regulation of labor and industry in the country.

The reason for this dissatisfaction with the legislation of 1869 is found in the rapid growth of the factory system after the war with France, and the corresponding decline in importance and dignity of the old handicraft trades and trade guilds. This change was looked upon by many as a real misfortune. Coming at this time it was attributed largely to the code of 1869, which left the formation of and membership in guilds entirely voluntary.

The means for restoring the handicrafts to their old importance was sought in the restoration to power of the trade guilds. During the last thirty years there has consequently been a determined, and to a considerable extent successful, agitation for the enactment of laws giving increased powers to the guilds. The most radical demanded the organization of the handicraftsmen in each trade into compulsory guilds, with large powers for the regulation of trade matters.

Though conducted with great energy, this agitation was not productive of important results until 1881. A law was enacted July 18 of that year which introduced a number of the changes demanded. While failing to establish the principle of compulsory guilds, this law gave voluntary guilds a privileged position. It made them organizations of employers and journeymen carrying on a trade on their own account, with an authority of their own, and power to enact certain regulations, especially as regards apprenticeship, which should

have all the force of law even in respect to journeymen not affiliated with the guilds. They were to create and maintain aid funds and arbitration tribunals (*Schiedsgerichte*) for the adjustment of trade disputes and organize technical schools and other institutions for the advancement of the interests of their trades. An important change was the removal of the restriction, contained in the law of 1869, that each guild should embrace only members of the same trade, a restriction that had prevented the formation of guilds in small places. The guilds were made civil bodies, and given the power to hold land, to contract obligations, and sue and be sued in their corporate capacity. Finally, the collection of properly imposed dues was made enforcible by law.

This law was far from being as radical as was demanded, and the agitation for the extension of the guilds continued unabated. On December 8, 1884, a law was passed which declared that a journeyman not a member of a guild could have no apprentice. April 23, 1886, another law was enacted having for its purpose the encouragement of federations of guilds and outlining for them certain fields of activity. The movement was advanced another step by the law of July 6, 1887, which gave additional privileges to guilds, the most important of which was the power conferred on administrative authorities to compel employers and journeymen not affiliated with guilds of their trades to bear their share of the guild expenses for journeymen's shelters, trade schools, and arbitration tribunals.

Finally, this long series of laws reached its consummation in the very important law of July 26, 1897, in which was consolidated all the legal provisions regarding guilds, journeymen, and apprentices. In bringing together in one act these various provisions the Parliament at the same time introduced a number of important modifications in the prior existing laws. Most, if not all, of these changes have for their purpose the increase in power and importance of the guilds and the more rigid regulation of the right to work as journeymen, to have apprentices, etc. While a general system of compulsory guilds is not created, it is provided that where a majority of the persons interested are in favor of it a compulsory guild, to include all members of a trade in a certain district, can be created by the authorities. The essential features of this system are fully shown in the following paragraphs.

Persons carrying on trades on their own account can form guilds for the advancement of their common trade interests. The object of these guilds shall be: (1) The cultivation of an esprit de corps and professional pride among the members of a trade; (2) the maintenance of amicable relations between employers and their employees, and the securing of work for unemployed journeymen and their shelter during the period of their nonemployment; (3) the detailed regulation of the conditions of apprenticeship and the care for the technical and moral

education of apprentices; (4) the adjustment of disputes between guild members and their apprentices, as contemplated by the law of July 29, 1890, concerning industrial arbitration.

In carrying out this purpose the following line of action was specifically recommended by the law to the guilds: (1) The establishment of institutions for the development of the industrial and moral character of masters, journeymen, and apprentices, and notably the maintenance of technical schools and the promulgation of orders for their administration; (2) the determining of the conditions under which persons may become masters or journeymen and the granting of certificates to that effect; (3) the creating of a fund to aid guild members and their families, journeymen, apprentices, and helpers in cases of sickness, invalidity, death, or other trouble; (4) the organization of arbitration tribunals to take the place of the ordinary arbitration authorities for the adjustment of disputes between members and their employees; (5) the formation of a general business organization for the purpose of advancing the trades for which the guilds were created.

Membership in guilds is limited to the following classes of persons: Those who exercise in the district on their own account the trade for which the guild was created; those who hold the position of foreman or a similar office in a large establishment; those who fulfill the conditions of the above two classes, but have ceased to work without taking up any other trade, and handicraftsmen (*Handwerker*) working for wages in agricultural and industrial pursuits. Other persons, however, may be admitted as honorary members.

The admission of members can be made subject only to such examinations as are prescribed by the constitution, and this examination can relate only to the test of the ability of the applicants to carry on their trades. Membership can not be refused to anyone fulfilling the legal and statutory requirements, nor can anyone be admitted without fulfilling these conditions.

As has already been pointed out, the German Parliament, while desiring to foster the growth of trade guilds, was unwilling to take the radical step of making the formation of such institutions compulsory upon employers and journeymen. Instead, it adopted the compromise measure by which compulsory guilds should be created only under certain circumstances and when the persons interested seemed to favor their establishment.

The law thus provides that when the majority of the interested parties in a certain district consent to the introduction of the principle of compulsory guilds, the superior administrative authorities can establish such an institution. When this is done membership is compulsory upon all persons who on their own account carry on the trade to which the guild relates, whether they were in favor of a compulsory guild or not. Exception is made in favor of those persons who are at the head

of large industrial establishments (factories) and those who do not employ journeymen or apprentices. These persons, however, can become members if they desire to do so. The constitution of each guild determines, subject to the approval of the higher administrative authorities, the extent to which handicraftsmen, who are employed in agricultural and industrial pursuits for wages and as a regular thing employ journeymen or apprentices, and persons conducting a household industry, shall be members of the guild.

The following paragraphs, reproducing the more important provisions of the law regarding apprenticeships, show the great solicitude on the part of the State for the preservation of this system of trade instruction and the care taken that apprentices shall be thoroughly instructed in their trades:

In the handicraft trades only those persons have the right to direct apprentices who are 24 years of age and have completed the term of apprenticeship prescribed by the chamber of trades in the trade in which it is desired to instruct apprentices, or have exercised that trade without interruption for five years, either on their own account or as foremen, or in a similar capacity. The superior administrative authorities can, however, accord this right to persons not fulfilling these conditions. Before doing so they must take the advice of the guild to which the applicant belongs.

Apprenticeship can be served in a large industrial establishment or be replaced by work in an apprenticeship shop or other establishment for industrial education.

If an employer is a member of a guild, he is required to submit to it copies of all apprenticeship contracts made by him within 15 days after their conclusion. The guilds may require the contracts to be made before them.

In the absence of regulations promulgated by the Bundesrath or central State authorities, the chamber of trades and guilds can make provisions limiting the number of apprentices that may be allowed.

In general the term of apprenticeship is three years, though it may be extended by the addition of not more than one more year. The chamber of trades, with the approval of the superior administrative authorities, and after having consulted with the guilds and associations represented, may fix the duration of apprenticeship in each trade.

Upon completing his term of service, the apprentice must be admitted to the examination for a journeyman's certificate. This examination is taken before commissions, of which there is one for each compulsory guild. Other guilds can have an examining commission only when permission has been obtained from the chamber of trades. When provision has not been made for the examination of candidates for each trade, either by guild commissions, apprenticeship shops, trade schools, or State boards of examiners, the necessary commissions will be created by the chamber of trades.

The examining boards must consist of a president, appointed by the chamber of trades, and at least two members, half of whom are elected by the guilds and half by the journeymen's commission. The examination must show that the apprentice is able to perform the duties of his trade with sufficient skill; that he knows the character and value

of the materials he must make use of, and that he knows how to take care of them. The knowledge of bookkeeping and accounts may also be required. The result of the examination is entered upon the apprentice's certificate.

The title of master can be borne only by journeymen who, in their trade, have acquired the right to have apprentices, and who have passed the master's examination. In general this examination can be taken only by those who have exercised their trade as journeymen for at least three years. The examination is given by a commission composed of a president and four other members chosen by the superior administrative authorities, and must show that the candidate is able to value and execute the ordinary work of his trade, and that he possesses other qualifications, especially ability to keep books and accurate accounts, fitting him to carry on the trade on his own account.

The duties imposed upon the employer are to instruct the apprentice in all matters relating to his trade; to require him to attend an industrial or trade continuation school; to see that he applies himself zealously and conducts himself properly; to guard him against bad habits, and to protect him from bad treatment on the part of members of his household or companions. The employer must personally direct the work of the apprentice, or place him under the direction of a competent person charged with his special instruction. He can not require of him work beyond his strength or that which may be injurious to his health, and must not deprive him of the time necessary for his school instruction or for divine worship. Apprentices not living at the houses of their employers must not be required to perform household duties.

If the number of apprentices of any employer is out of proportion to the amount of the latter's business and the instruction of the apprentices is thereby jeopardized, the lower administrative authorities may compel the dismissal of some of the apprentices and forbid the taking on of new ones, so as to bring their number within a certain limit.

The Bundesrath can determine for special categories of industries the maximum number of apprentices that may be employed. Until fixed in this way the central Government can take similar action, and when this Government fails to act the chamber of trades can limit the number of apprentices.

This law has been in operation for so short a time that it is impossible to determine definitely what its ultimate workings will be. Opinions on the subject are contradictory. It would seem, however, that beneficial results are in many cases being accomplished. Thus, in 1898, Mr. Buyse, in his official report to the Belgian Government, on technical schools in the building and wood industries of Germany, writes as follows:

Nothing is more instructive than to see with what enthusiasm the masters have responded to the wishes of the legislators as expressed in section 97 of the industrial code, "The guilds have specially the right to organize and direct trade schools." Education is the true function of the guild. These small employers, supported by their workmen, do not recoil before the sacrifices necessary. Regardless of the fact that they are forming competitors in the market, they are seeking to

enfranchise the workman by the cultivation of his intelligence and to improve his condition by improving his work. Their activity embraces labor in all its forms, and not alone in the trade school; it also extends to the vigilant supervision of apprenticeship in the shop, and of the conduct and housing of the apprentice, all of which is controlled by the tests required of persons before they are granted the right of working as journeymen or masters.

It can be said that the enthusiasm in favor of trade education comes from the employers. Nine-tenths of the trade schools (*Fachschulen*) and the courses of lectures on trades are the work of the guild schools, the origin of many of which was in the middle ages. Organized at first on a very modest basis at the exclusive expense of the guilds with courses of only a few hours a week, directed by persons actually in the trades, and having reference strictly to trade needs, they have elicited the attention of the public authorities. Many of the guilds have obtained for their schools subsidies fixed on the basis of a contract determining the reciprocal obligations of the communes and guilds. Their schools have thus become permanent and durable institutions. Under the impulse of new needs they have rapidly developed, increasing in number and in the scope of their work. * * * The character of the instruction has been transformed and the standard raised, thanks to the subsidies of the cities, but its fundamental principles, which it owed to its origin, have not been changed.

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The guilds render great service to the State, of which indeed they are really agents. The State confers upon them a part of the public power and accords to them the right of monopoly in respect to apprenticeship and trade standing. It is even proposed to make the guilds obligatory in order to give to them greater stability and strength. The State thus transfers from itself to the guilds the care of the organization of labor in the small trades. It confers upon them the power to establish such institutions as may be necessary for the trade training, both for the employers and employees. It confides to them the supervision of the execution of labor and apprenticeship contracts and the regulation of disputes between employers and their employees. It gives to them the right to create funds for insurance against sickness and unemployment, and charges them specially with the training of future employees.

* * * * * * *

Thanks to the guilds the apprentice is no longer an unfortunate being, exposed to the hazards of life and left to his own weakness. He is surrounded with attention and his education is obtained under the most favorable conditions. From his entrance into the trade the guild looks after him. It supervises the punctual execution of the apprenticeship contract, controls the nature of the work in which his employer instructs him, takes account at least once a year of the progress realized and as a test of his studies makes him give a proof of his ability, and gives to him his certificate of apprenticeship. This certificate is a reliable document of influence throughout the Empire. The young journeymen find a cordial reception among the federated guilds in all German cities. The master who employs him can judge of his ability and assign him work in accordance, because the declarations of the guilds are sincere and generally furnish a perfect guaranty that he has the necessary theoretical and practical knowledge.

Practically all of the guilds contain a clause in their constitution which provides that "the members of the guild obligate themselves to require of their apprentices attendance upon a trade school recognized by the guild, and to encourage them to arrive promptly at the school and to apply themselves with sustained zeal."

The guilds also, in all cases, provide for the institution of an apprenticeship commission, the duty of which is to see that the conditions of apprenticeship are faithfully observed. At least as often as once a year they visit the shops and satisfy themselves that due care has been taken by the employers to instruct the apprentices under their charge. Especially do they seek to satisfy themselves that the provision of the industrial code which requires that masters shall instruct the apprentices in all the different branches of the trade is being complied with.

The local authorities, who are also interested in the education of the young workers, usually place at the disposal of the guild contemplating the maintenance of a school a suitable building which they afterwards heat and care for. Often they also assist by the grant of a subsidy. In small towns the same school includes courses on different trades, but in all the larger cities there are distinct schools for the different trades.

The organization of the teaching force and of the programme of instruction is such as would be expected of an institution supported by persons actually engaged in the work taught. For the most part the instruction is given by members of the guild who are willing to sacrifice a certain portion of time from their work for this purpose. The instructors of drawing, however, must have a more careful technical training.

As regards the instruction given, everything is subordinated to making it as practical as possible. The courses are in no sense institutions preparing for secondary technical schools. Their purpose is solely that of making the students more efficient workmen in the trades in which they are at the time apprenticed. They are thus trade schools in the fullest sense of the word. The fact that the instructors are for the most part members of the guild, actually following the trade, insures that the instruction will always keep in view actual trade needs.

The principal resources of the schools are the dues required of all members of the trade of the district, including even those who are not members of the guild, for, as we have seen, the guilds have been given the power to require all the persons in the trade to contribute to the support of institutions having for their purpose the advancement of the general trade interests. In addition to these contributions it is usual for the local authorities to furnish quarters for the school and to defray the expenses of heating and maintenance. Not infrequently subsidies are also obtained from these authorities and from the Government.

INDIVIDUAL SCHOOLS.

In the pages which follow a detailed account is given of important or typical industrial schools of each of the foregoing classes which come within the scope of this report. The schools are described in the order of the classification already given. The first two classes of industrial institutions mentioned in the classification—namely, the technical colleges and the secondary or intermediate technical schools—do not come within the scope of the present report, and hence none of these institutions is described in detail. The industrial drawing courses have been sufficiently described as a class and need not be considered individually. The first class of institutions considered for individual description, therefore, is that of schools and museums of industrial art.

SCHOOLS AND MUSEUMS OF INDUSTRIAL ART.

Among the institutions coming under this class in Germany the following, which have been selected for description, are sufficiently important or typical to give a fair idea of the character of industrial art education in that country:

SCHOOL OF INDUSTRIAL ART, BERLIN, PRUSSIA.

Berlin is in possession of a magnificently housed and well-equipped school of industrial art (*Unterrichtsanstalt des Kgl. Kunstgewerbe-Museums*). Its purpose is to develop the artistic sentiment in all branches of industry in which it can find a place. The instruction is directly industrial.

The courses last during the day from 8 a. m. to 4 p. m. and the same courses are repeated in the evenings from 5 to 10 o'clock. Applicants for admission to the school must have followed the course of the preparatory art classes specially organized for the industrial art school, or possess an equivalent education. These requisites, in other words, are: A knowledge of ornamental designing, of designing in plaster, and of proportion, and a knowledge of architectual designing, of modeling, or of painting, according to the course to be pursued. The student must also show that he has practiced the trade for which he wishes an art training at the school.

As in many cases it would be difficult for the student desirous of attending the industrial art school to attend the preparatory courses, evening classes have been organized in the latter department for general art training, such as drawing, ornamentation, architecture, modeling, history of styles, etc. These classes are preparatory to the day courses and in a measure complementary to them. In addition, students who are deficient in any respect are allowed to make up their deficiency in these classes. Apart from this there is no connection between the day and evening courses.

Every effort is made to keep the student in constant touch with the industry to which he intends to apply himself. During the long vacation of three months he is encouraged to return to the shop and apply practically that which he has acquired at the school.

From the first day the instruction is specialized according to the trade the student expects to follow. There are special classes for each trade. Thus there are distinct courses in architectural designing for the wood and metal industries; modeling; engraving or chasing on different metals; decorative painting; pattern designing; enamel painting; designing and painting figures and plants; steel engraving and etching; artistic embroidery.

Most of these courses include not only class instruction, but also actual work in the shops connected with the school. There are shops for cabinetmaking and wood carving; for painting on enamel, china, and glass, with kilns for burning the articles decorated; for artistic ironwork, with the necessary forges; for chasing and engraving, where artistic articles in copper, silver, and other metals are produced; for artistic modeling, the models for which are made in the school, though outside foundries must be used to cast this kind of work.

All of these shops produce articles of real artistic value, which are sold for the benefit of the school. It is said that little difficulty is experienced in finding purchasers for the articles. The Government has purchased quite a number of the articles for use in the various Government departments.

The school is in possession of a valuable collection of models. Being a part of and housed in the well-known Museum of Industrial Art, it has at its disposal the library and excellent collections of that institution.

In 1900–01 there were 207 students in the day school and 320 in the evening school, making a total of 527 students. Among the students all of the important artistic trades were represented, namely, architects, builders, wood carvers, sculptors, modelers, chasers, engravers, jewelers, artistic iron workers, painters, painters on glass and porcelain, lithographers, industrial designers, etc.

The total expenses of the school for that year amounted to 166,000 marks ($39,508).

Professor Pyfferoen, the Belgian expert, regards this school as the most important of its kind in Germany.

SCHOOL OF BUILDING AND INDUSTRIAL ART, KAISERSLAUTERN, BAVARIA.

The object of this school is the education of young persons who desire to enter the building trades and the art industries, such as woodworking, art metal working, engraving, painting, etc. The courses in the school of industrial art last three years, and are divided into six departments, namely: Building and art woodworking; building and art ironworking; stone carving, modeling, stucco working; wood

and ivory carving; chasing, engraving, goldsmithing, silversmithing; decorative painting, pattern designing, lithographing, decorating.

Boys must as a rule be 15 years of age before they are admitted to the school, and must possess a good common school education.

The school is under the control of the Bavarian minister of the interior; it is directed by a rector, assisted by 19 teachers and 6 master workmen, part of whom also teach in the building-trades school.

The general scope of the instruction can be seen from the annexed table showing the hours per week devoted to each subject. The number of hours given to practical work in the school workshops is evidence of the importance attached to this part of the instruction. The instructors are all men who have had experience in practical business work, and who continue to execute orders in their various fields in addition to their teaching.

The number of pupils in attendance during 1900–01 was 115. The tuition fee is 20 marks ($4.76) per year; for nonresidents of the palatinate, 40 marks ($9.52). An extra fee of 10 marks ($2.38) per semester for workshop expenses is charged.

A Sunday school giving drawing courses in industrial art work is annexed to the school; it is arranged for those artisans who have advanced beyond the grade of work done in the continuation schools and who wish further instruction. A fee of 4 marks (95 cents) per year is charged for residents of Kaiserslautern; nonresidents are charged 6 marks ($1.43). In 1900–01 there were 73 students in attendance.

In common with many other schools, means were provided from the school funds to enable the instructors to visit the Paris Exposition of 1900. During the summer of 1900 the school also gave a special course in drawing for teachers of that branch in the industrial continuation schools.

Following is the hour schedule adopted in the school of industrial art, the total number of hours in each course amounting to 44:

DISTRIBUTION OF HOURS OF INSTRUCTION IN THE SCHOOL OF INDUSTRIAL ART, KAISERSLAUTERN.

Studies.	Woodworking.			Ironworking.			Stone carving.		
	First year.	Second year.	Third year.	First year.	Second year.	Third year.	First year.	Second year.	Third year.
German language	4	4		4	4		4	4	
Bookkeeping			4			4			4
Arithmetic	4			4			4		
Geometry		2			2			2	
Estimating costs			2			2			
Free-hand drawing	8			8			8		
Drawing from casts and nature		4	4		4	4		4	4
Ornamental forms	2			2			2		
Geometrical drawing	4			4			4		
Projection and shading		4			4			4	
Perspective			2						
Architectural and ornamental drawing		12	14		12	14		6	8
Modeling				4			8	10	10
Practical work	22	18	18	18	18	20	14	14	18

DISTRIBUTION OF HOURS OF INSTRUCTION IN THE SCHOOL OF INDUSTRIAL ART, KAISERSLAUTERN—Concluded.

Studies.	Wood carving.			Chasing and engraving.			Painting.		
	First year.	Second year.	Third year.	First year.	Second year.	Third year.	First year.	Second year.	Third year.
German language	4	4		4	4		4	4	
Bookkeeping			4			4			4
Arithmetic	4			4			4		
Geometry		a 2			a 2			a 2	
Estimating costs									
Free-hand drawing	8			8			8		
Drawing from casts and nature		4	4		4	4		4	4
Ornamental forms	2			2			2		
Geometrical drawing	4			4			4		
Projection and shading		4			4			4	
Perspective									2
Architectural and ornamental drawing		6	8		6	8		12	12
Modeling	8	10	10	8	10	10			
Practical work	14	14	18	14	14	18	22	18	22

a Optional.

ROYAL SCHOOL OF INDUSTRIAL ART, MUNICH, BAVARIA.

This institution, known as *K. Kunstgewerbe-Schule*, was founded by the Government of Bavaria in 1868, and is under the immediate supervision of the department of the interior for church and school affairs. Its purpose is to offer opportunity for an artistic education, with special reference to the various branches of industrial art. Incidentally, it also offers opportunity for the education of drawing teachers, and a preparation for higher art studies and for schools of painting. It comprises two separate divisions, the school for males and the school for females, the latter organized in 1872. Each division has its separate course of studies and occupies separate class rooms. The school year begins October 1 and continues until July 14, with the usual holiday vacations. It is divided into two terms, separated by an intermission of two weeks during the Easter holidays. The hours of instruction are from 8 to 11.30 a. m. and from 2 to 5 p. m. The school remains closed on Sundays, holidays, and Saturday afternoons.

Students pay an entrance fee of 10 marks ($2.38). Tuition for residents of Germany is 20 marks ($4.76) for the winter term and 10 marks ($2.38) for the summer term; for residents of foreign countries, 40 marks ($9.52) for the winter term and 20 marks ($4.76) for the summer term. In addition to the foregoing fees there is a hospital fee of 2 marks (48 cents) for the winter term and 1 mark (24 cents) for the summer term. Students in needy circumstances who are residents of Germany may have their tuition fees remitted in certain cases. During the school year 1900–01 scholarships from the Maximilian fund were granted to 18 students to the amount of 360 marks ($85.68) each, or a total of 6,480 marks ($1,542). Other scholarships, amounting to a total of 1,310 marks ($312) from various other funds, and several scholarships for which the figures were not ascertained were also granted during the same period.

An applicant for admission to either school must have attained the age of 15 years; must produce satisfactory certificates from former schools, and pass an examination in elementary free-hand drawing. Male applicants may substitute modeling for free-hand drawing.

During the school year 1900–01 the faculty of the school consisted of 1 director and 19 instructors.

The following is a programme of the courses of study in the school for males, with the number of hours per week devoted to each:

COURSE FOR DESIGNERS, DECORATIVE PAINTERS, LITHOGRAPHERS, PAINTERS ON GLASS AND CHINA, ETC.

First year: Linear drawing and aquarelle, 7; ornament drawing, 21; ornament painting, 9; history of art, 1; style, 1; geometry and projections, 3.

Second year: Architectural drawing, 7; ornament painting and flower drawing and painting, 10; figure drawing, 10; history of art, 1; style, 1; perspective and shadows, 2; anatomy, 1; and either ornamental designing, figure decoration, decorative painting, or glass and china painting, 10.

Third year: Architectural drawing, 7; figure drawing, 10; anatomy, 1; and either ornamental designing, figure decoration, decorative painting, or glass and china painting, 24.

COURSE FOR ARCHITECTURAL DRAFTSMEN, MODEL MAKERS, SCULPTORS, JEWELERS, CHASERS, ETC.

First year: Linear drawing and aquarelle, 7; ornament drawing, 9; modeling of ornaments and of the human figure, 21; history of art, 1; style, 1; geometry and projections, 3.

Second year: Architectural drawing, 7; drawing and modeling of the human figure and modeling of ornaments, 20; history of art, 1; style, 1; perspective and shadows, 2; anatomy, 1; and either xylography, architecture, sculpture, or chasing, 10.

Third year: Architectural drawing, 7; drawing and modeling of the human figure and modeling of ornaments, 10; anatomy, 1; and either xylography, architecture, sculpture, or chasing, 24.

Following is a synopsis of the foregoing subjects:

Linear drawing and aquarelle: This subject, in connection with the lectures on geometry, projections, and perspective, forms the basis of constructive drawing as far as it is applicable to the purposes of this institution. It embraces exercises in drawing from copies of simple geometrical figures, as scroll work, network, checker work, framework, etc. The drawings are rendered in pencil, in ink, and in colors, and represent mainly the decorative features of ceramics and of the textile industry.

Architectural drawing: Studies in architectural forms as far as they are applicable to the objects of industrial art.

Ornamental drawing: Exercises in outline drawing from gypsum models of ornamental forms on various scales and with regard to effects of light and shadows.

Ornament painting: Exercises in polychromatic ornaments of the different art periods. Studies from patterns in ceramics and the textile industry, especially of Grecian vases, mosaics of oriental and renaissance styles, checkerwork, sgraffito, etc.; transferring relief forms in polychromatic patterns; finishing in aquarelle.

Flower drawing and painting: Drawing and painting leaves, flowers, vines, etc., from copies, casts, and living plants, with reference to their use in ceramics, decorating, textiles, tapestry, etc.

Figure drawing: Drawing of simple parts of the human body, followed by drawing of the whole figure, from copies and gypsum models. Also exercises in drawing animals and drapery.

Modeling of ornaments and of the human figure: Exercises in producing plastic ornamental forms of simple and more complex types in various positions; modeling of simple parts of the human body followed by modeling of the whole figure from gypsum models; modeling of animals and drapery.

History of art: Lectures on the development of art in connection with the history of civilization from antiquity to modern times, prominently the most important periods and nations and the most distinguished artists and works of art.

Style: Lectures on style; consideration of the most important ornamental forms and their application; explanation of attributes, emblems, allegories, and symbols; heraldry; science of colors; characteristics and theory of style of the formative arts and the various industrial art technics; comparison of historic styles.

Geometry and projections, perspective and shadows.

Anatomy: Lectures and illustrations with reference to the special work of the student.

Architecture: Studies in those branches of industrial art which pertain mostly to the exterior and interior ornamentation of buildings. They include the decorative works of the builder and cabinetmaker, ceramic decorations, the decorative work of the goldsmith, locksmith, turner, etc.

Ornamental designing: Studies in designing of surface ornamentation; all kinds of textiles, marbled paper, drapery, leather, etc.; embroidery work, lace work; typographical decorations, etching and engraving, checkerwork, mosaic work, etc. Instruction is based upon studies of the older styles with the application of the same to more modern work.

Figure decoration: The studies in this subject are based upon the studies in surface ornamentation by the use of the human figure. They embrace decorative painting of walls, ceilings, windows, etc., typographical decorations, vignettes, etc., in so far as the use of organic forms for ornamental purposes is admissible.

Decorative painting: A special course in decorative wall painting. Exercises in painting from plastic copies in single colors followed by polychromatic representations; exercises in painting walls and ceilings with reference to copies from Italian and German decorative painting; free decorative representations of flowers, figures, animals, etc., for friezes, panels, medallions, etc.

Glass and china painting: Exercises in connection with studies in decoration of windows and of ceramic objects. These exercises begin with painting simple ornamental surfaces, followed by architectural and figural representations in gray and polychromatic painting with accentuation of the mosaic principles of the old masters. Painting of porcelain and china ware, vases, etc.

Sculpture: Studies in designing plastic decorations of ornamental and figural character for ornamentations on buildings and furniture, on ceramic objects, and for the metal industry, as capitals, pilaster fillings, friezes, brackets, caryatids, cappings, rosettes, vases, pedestals, stoves, centerpieces, goblets, cassettes, etc. Instruction is based upon correct samples with constant reference to the materials which enter into the construction of the objects. The models are made either of clay, gypsum, wax, or wood.

Chasing: Studies and practical instruction in all kinds of metal work pertaining to chasing and engraving. The instruction embraces essentially exercises in metal stamping, chasing, engraving, etching, and enameling in connection with instruction in drawing and modeling of metallic objects.

Xylography: Exercises in wood carving and graphic representation by means of wood cuts in connection with ornamental and figure drawing.

In addition to the foregoing courses there is also a special course arranged for drawing teachers. The course embraces instruction in the following subjects: Linear and projective drawing, architectural drawing, ornamental and figure drawing, modeling, history of art, and methods of teaching drawing. The instruction in this course has constant reference to the various branches of industrial art in order that the student in his future profession as drawing teacher may remain in constant touch with the practical side of industrial pursuits.

Instruction in the school for females, partly by lectures and partly by practical exercises, embraces the following subjects: Technical drawing (linear drawing and aquarelle, geometry and projections, perspective and shadows), ornament drawing, ornament painting, drawing and painting of flowers, figure drawing, including animals and drapery, style, ornamental forms, history of art, and the special courses of industrial drawing, decorative drawing and painting, china painting, lithography, xylography, and a course for drawing teachers.

The number of students in attendance during the school year 1900–01 was as follows: Males, 191; females, 139; total, 330. The following table shows the residence of students by countries:

NUMBER AND SEX OF STUDENTS IN THE ROYAL SCHOOL OF INDUSTRIAL ART, MUNICH, BY COUNTRIES, 1900–01.

Countries.	Males.	Females.	Total.
Bavaria	120	102	222
Other German States	45	30	75
Foreign	26	7	33
Total	191	139	330

SCHOOL OF INDUSTRIAL ART, DRESDEN, SAXONY.

The School of Industrial Art at Dresden does not rank so high in the grade of instruction offered as does the school at Berlin, nor is it as well provided for in respect to buildings. A department for industrial art work had existed in connection with the Polytechnikum since 1828, but was made an independent school in 1875, with a director and 19 instructors. The number of pupils in attendance steadily increased until in 1899 it was 278, while the preparatory department had 99 students. Lack of room forces the school authorities to turn away many applicants each year.

Applicants for admission must have taken the courses at the preparatory school or possess a similar education or have been employed for three years in the trade for which they seek instruction. They must be at least 16 years of age.

The following departments exist in the day school: Building trades (decorators, paper hangers, cabinetmakers, etc.); designing of patterns;

decorative painting; porcelain painting, color printing, lithographing; modeling of figures and objects; chasing; general and theater decorating; designing of industrial objects.

Each of these has courses of instruction of its own, with separate classes. The pupils are first given instruction as to the value of artistic articles used in the trade, description of the materials, methods of construction, and style. The objects are analyzed from a technical and artistic point of view, and the pupils are taught to design the artistic details, and, finally, to make complete articles designed by themselves.

The evening school requires that pupils shall be 14 years of age on admittance and possess some skill in drawing. The instruction is specialized as much as possible, and in order to encourage those working at trades to study at the school new students are allowed to enter each month. The courses require from 4 to 12 hours per week, and take up work connected with the building trades, modeling, designing, industrial art painting, painting of figures, and preparatory work in designing.

The number of students that had taken courses in the day school up to December, 1899, was 1,647. These graduates have gone into the following trades:

Decorative painting, china painting, lithographing, color printing	754
Pattern designing	314
Wood carving and metal chasing	299
Artistic work connected with building trades (ironworkers, woodworkers)	226
Teachers of drawing	54
Total	1,647

In the evening school the trades of the students in attendance, together with the numbers in each trade, were as follows:

Decorative painters, china painters, lithographers, pattern designers	654
Cabinetmakers, locksmiths, braziers, tinsmiths, goldsmiths, paper hangers, leather workers	416
Modelers, wood, stone, and ivory carvers	284
Engravers, chasers	126
Miscellaneous trades	254
Without any trade	60
Total	1,794

The fees per half year for the day school are 30 marks ($7.14) for Germans and 45 marks ($10.71) for foreigners. For the evening courses the fees are from 1 to 2 marks (24 to 48 cents) per month, according to the number of hours of attendance.

The total expense incurred on behalf of the school for the year 1898–99 was 193,600 marks ($46,077). The receipts from tuition fees were 10,546 marks ($2,510).

SCHOOL OF TEXTILE ART, PLAUEN, SAXONY.

This is a State institution devoted to giving instruction in industrial art as applied to the textile trades. It is a good example of an educational institution specialized to advance the industries of the district in which it is located. The school was founded by the city of Plauen in 1877 as a drawing school, and in 1890 was taken over by the State and enlarged to its present dimensions. It is now housed in a good-sized building and possesses a valuable collection of textiles. To place the facilities of the school at the disposal of as many persons as possible branches were opened in 1896 at Auerbach and Falkenstein and in 1899 at Eibenstock. In these branches instruction in drawing and pattern designing is given to young persons engaged in the industry.

The school at Plauen comprises three departments, one giving courses to prepare for positions as designers, another to prepare young men as manufacturers and factory superintendents, and one for women.

The department for designers is the most important. The possession of good designers is to-day the point which largely decides the fate of textile establishments, and only a thorough system of special instruction can fill this need. The school at Plauen aims to give its students a good knowledge of the different types of ornamentation and their historical development, and special care is taken to demonstrate the infinite variety of decoration which the study of plants has afforded. The school also offers sufficient instruction in regard to the technical details of the industry to enable the designer to appreciate the limitations which the processes of production place on artistic merit. This instruction is given in the weaving and embroidery rooms of the school, where the students have practical work on the machines.

The institution has succeeded in training up a body of designers for the district who have maintained a high standard of excellence in hand and machine embroidery, tapestries, laces, rugs, and curtains. Because their training is not confined to a narrow specialty these men are able to turn their abilities in many directions, and find no inconvenience in the rapid changes of fashions which characterize the textile industries.

The department for manufacturers and factory directors is a weaving school on a small scale, and in general follows the plans used in the other textile schools of the State.

The women's textile trade department was added to the institution in 1891. Its object is to train women desiring to fill positions as superintendents of garment-making establishments, and it offers general courses of instruction in embroidering and in the making of

lingerie, etc.; these two industries being a specialty of the district of Plauen.

The candidates for admission to the school are required to have a higher primary education; and, in addition, those desiring to enter the department for designers must submit evidence of possessing some natural ability in such work. As a matter of fact it is interesting to note that the school often discourages pupils from taking the course in design if they show themselves without talent in that direction. The full course for designers lasts 4½ years; for manufacturers and others, 3 years; for the women's section, 1½ years. The tuition fee for the designers' course is, for Germans, 60 marks ($14.28) per year; for foreigners, 200 marks ($47.60) per year. For the manufacturers' course the fee is 45 marks ($10.71) per year, foreigners being charged double rates.

The teaching force of the school in December, 1899, was composed of a director and 19 instructors, 5 of whom were women. The number of students in attendance in each school was as follows:

Department for designers	57
Department for manufacturers	10
Department for women	36
Evening course for designers' assistants	12
Branch schools	50
Total	165

For the school year 1898–99 the total expense of maintenance was 95,606 marks ($22,754). The tuition fees amounted to 5,224 marks ($1,243) and the net expense to the State was 88,699 marks ($21,110).

ROYAL MUSEUM OF INDUSTRIAL ART, BERLIN, PRUSSIA.

This museum is, without doubt, one of the best in Europe, and ranks with the South Kensington Museum, at London, in point of wealth and arrangement. It possesses a magnificent building, especially erected for it, and is thus enabled to have a systematic classification of its exhibits. These are arranged, first, according to material, and, secondly, according to epochs. The copper, bronze, glass, iron, and tapestry divisions have each separate halls; the furniture is arranged in separate rooms furnished with authentic pieces so as to offer a complete set of the style or period represented. This method has been found to produce excellent results in arousing the interest and educating the taste of the artisans, who are encouraged to visit the institution. The department of ceramics, china, and porcelain is very rich.

The museum is open without charge all day, including Sundays. Connected with the museum is the industrial art school already described.

MUSEUM OF INDUSTRIAL ART, NUREMBERG, BAVARIA.

The following is a condensation of the account of this museum, given by the English Technical Instruction Commission in 1896:(a)

According to the prospectus the work of this institution is carried on under eight different divisions:

The collection of patterns or samples, which consists of 10,000 specimens of ancient and modern examples of works in wood, metal, glass, clay, leather, and paper; also woven fabrics, embroideries, laces, etc. Certain of these objects can be obtained on loan. This section is really the applied-art museum, as the specimens comprise examples of workmanship from all countries and of the best periods of art.

The collection of designs, which consists of some 60,000 sheets of illustrations of art industries of all periods and all nations. These mounted sheets are classified under various heads, and arranged in glass cases for easy reference by manufacturers and students. To procure these designs recourse has been had to illustrated works on ornamental and art workmanship and to the best serial publications of all countries. Opportunity is afforded for consulting them and for copying them, and the officials undertake to prepare special designs and sketches for fees to be arranged.

The library and reading room contains upward of 13,000 volumes of art, industrial, and technical works; also about 136 journals and periodicals relating to these subjects, which are taken regularly and filed. In connection with this section there is an extensive series of foreign directories, trade catalogues, and address books of other countries. All the above departments are open free to the public.

The mechanical and technical division may be said to include two chief departments:

I. The office for specialized trade information relative to (1) patents, merchandise marks, and trade-marks. In this section applicants can have patents secured for them at fixed charges, and trade-marks can likewise be registered. (2) For furnishing information of all kinds on motors, machines, tools, raw products, and manufactured goods. (3) For supplying literary advice and references from technical works, and giving replies to general technical questions.

II. This constitutes the experimental research department, arranged for the trial and testing of gas, benzine, and petroleum motors, steam engines, water wheels, turbines, and electro-motors, as also all labor-saving machinery at agreed charges.

The chemical laboratory, which occupies itself with investigations of all kinds relative to technical and industrial chemistry, and further is prepared to undertake analysis and to carry out more extensive researches for fees to be arranged. The official testing station for paper is in connection with this branch.

A permanent exhibition of modern industry and art. Temporary exhibitions of special departments of manufactures. Distribution of prizes to meritorious exhibitors out of a fund founded by King Ludwig of Bavaria.

Issue of the Bavarian trade journal delivered to subscribers of the institution at the price of 10 marks ($2.38); to nonmembers, 16 marks ($3.81) per annum. This is the official organ of the Bavarian Industrial Museum.

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a Report on the Recent Progress of Technical Education in Germany, 1896.

The delivery of public lectures and addresses during the winter months, embracing information on all subjects of art applied to industry and every branch of manufacturing activity. Lectures to the members of allied societies in other towns. Classes for technical drawing for adults engaged in industrial pursuits.

An interesting feature in the activity of this museum is the so-called Gewerbe-Archiv, or factory register, which includes a brief account of all the more important industrial establishments in Bavaria, contributed by the manufacturers themselves on a special form. The particulars given are as follows: The name and address of the firm, when founded, articles produced; whether special to this undertaking; character of motive power employed; nature of machinery used, and the number of each kind of machine; patents, trade-marks, etc., owned by the firm with indication of registered number, etc., of the same; expositions in which the firm has taken part and prizes and medals awarded. Further, as optional information, the number of work people employed and the annual value of productions. Many thousands of manufacturers have already contributed to this register, and every effort is made to keep it up to date and to render it accurate and complete as a record of the whole of the industries of Bavaria.

MUSEUM OF INDUSTRIAL ART, DRESDEN, SAXONY.

The Dresden Museum is one of the important museums covering all classes of artistic industrial products. It is especially well provided with specimens of ceramic wares, textile products, precious-metal products, jewelry, etc., products of trades connected with building operations, and decorative painting. There is a separate museum for ceramics in Dresden; therefore, that department of this museum is not extensive in comparison with other departments, although two large rooms are required to house its ceramic exhibits.

The collection of Cordova leather work is well known for its beauty of design; then come departments for bookbinding; furniture of various kinds and styles; jewelry; locksmiths' work, and artistic iron-work; and products in copper, tin, and bronze. From time to time special exhibitions of certain articles are held in the museum, and as a rule succeed in stimulating considerable interest. Parts of the collections are frequently sent to provincial towns for temporary exhibitions.

There is no charge for admission to the museum, which in 1898–99 was visited by 15,500 persons. There were 3,690 objects used for drawing, while 1,060 objects were loaned for various purposes.

MUSEUM OF TEXTILE ART, PLAUEN, SAXONY.

While this museum is only a part of the School of Textile Art of Plauen (previously described), it must be regarded as one of the foremost museums of the country and is of especial interest because of the efforts to make it directly serviceable in the industry which is the specialty of the Plauen district. The museum comprises only textiles

and graphic reproductions of textiles. These are divided into six classes, namely, embroideries, laces, tissues, curtains, prints, and passementeries. The collection of modern textiles is probably as complete as is to be found anywhere. In distinction from other museums, no effort is made to collect objects of historical interest or of value because of their rarity. Only new or recent products are purchased, and only such as would be of service in educating students and manufacturers. As a result, the industrial population takes an active interest in the museum, and the funds expended for it produce correspondingly good results.

Every year the head of the museum visits the various textile centers to make purchases of samples of new products. These samples are exhibited in a special room where they can be seen by those interested. This allows the local manufacturers to compare their own products with the best products of their competitors, both home and foreign.

The museum also possesses a large collection of samples, about 70,000 in number, in addition to the 10,000 full pieces of woven goods, laces, etc. Many of the samples are bound in books and are kept on tables for ready reference, while others are mounted on rollers. The important pieces are hung in full lengths, so that their total effect can be seen. Some of them are 10 meters (32.8 feet) square.

One of the best features of the museum is its connection with the sample-collection system of the Vogtland-Erzgebirge Industrial Association. This is an association of private persons formed by the present director of the textile school of Plauen for the purpose of aiding the textile industry of the district by establishing traveling exhibitions of textile products of artistic value. In eight of the small towns in the district adjoining Plauen branch museums have been established, which are supported by the association. Every three months new specimens are received from the Plauen museum, while the association purchases additional samples as far as its means allow. All articles purchased by the association are at once turned over to the State. In the year 1898–99 the number of articles exhibited in these traveling collections was 2,306. In 1899–1900 the Government contributed 8,000 marks ($1,904) for the purchase of samples, while the association expended 8,300 marks ($1,975) in supporting and enlarging the collections.

SCHOOLS FOR FOREMEN.

These schools, as previously stated, relate mostly to the industry of machine construction. Those selected for detailed description are the School of Machinery Construction and Metallurgy, Duisburg, and the School of Machinery Construction, Dortmund, Prussia; the Royal School of Machinery Construction attached to the State technical

schools, Chemnitz, Saxony, and the Technikum at Hamburg. The latter comprises schools of machine construction, steamship-machinery construction, shipbuilding, and electro-technics.

SCHOOL OF MACHINERY CONSTRUCTION AND METALLURGY, DUISBURG, PRUSSIA.

The object of this school is to prepare foremen for smelting works, rolling mills, and machine shops, and to educate draftsmen for these industries. The present school was formerly located at Bochum, but, because of lack of support from the local authorities, it was moved to Duisburg. That city now contributes 15,000 marks ($3,570) annually to its support, while the amount of the State contribution is about 50,000 marks ($11,900). The citizens have shown a lively interest in the welfare of the school and have regularly made contributions to assist needy students. The building which the school occupies is the gift of a citizen of Duisburg.

The scope of the education offered is limited to that necessary to prepare foremen and persons holding inferior executive positions. The school gives instruction in the trades of blacksmithing, locksmithing, coppersmithing, tinsmithing, etc. There are two departments, one for machinery construction and the other for metallurgy, the latter comprising smelting and rolling-mill operations. In both the instruction is essentially theoretical. There is no opportunity, except in drawing, for the student to do any practical work. The school does not possess even a chemical or a physical laboratory. The reason for this is that students are required to have had at least four years' experience in their trades before they are admitted. The need of the pupils is therefore theoretical instruction to supplement their workshop experience. The courses require the whole time of the students for two years. This feature of the school has been criticised on the ground that the length of time required debars many from availing themselves of its advantages, and it has been suggested that by cutting out the elementary work in German language, arithmetic, penmanship, and similar subjects the time could be reduced one-half. This suggestion, however, ignores the general principle underlying the whole German educational system, that, as far as possible, a well-rounded education must be striven for and that the State aims always to qualify the pupil for civic as well as industrial life.

The following table shows the subjects taught and the time devoted to each:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, SCHOOL OF MACHINERY CONSTRUCTION AND METALLURGY, DUISBURG.

Subjects taught.	Hours per week.											
	Machinery construction.				Smelting and refining.				Rolling-mill work.			
	1st half year.	2d half year.	3d half year.	4th half year.	1st half year.	2d half year.	3d half year.	4th half year.	1st half year.	2d half year.	3d half year.	4th half year.
German language and law	4	4	2	2	4	4	2	2	4	4	2	2
Bookkeeping				2				2				2
Arithmetic	4	1			4	1			4	1		
Mathematics	8	6	4	2	8	6	4	2	8	6	4	2
Physics and electro-technics	4	3	2	2	4	3	2	2	4	3	2	2
Experimental chemistry	2				2	6			2	6		
Mineralogy						2	2			2	2	
Mechanics		4	4	4		4	2			4	2	
Theory of machinery		6					2				6	
Steam boilers and hoisting machines			6					[a]4				[a]4
Steam engines and hydraulic and small motors				6				[a]				[a]
Technology of mechanics			4	4				8				8
Smelting and refining			2			2	6	4		2	6	4
Heating		3				3				3		
Chemical technology							4				4	
Estimating wages				6				2				
Rolling-mill sizes												6
Building			4									
Drawing	12				12				12			
Machinery drawing		6	8	8		2	4	2		2	6	8
Descriptive geometry		3				3				3		
Penmanship (engrossing)	2				2				2			
Practical chemistry							8	8				
First aid to the injured			1				1				1	
Total hours	36	36	37	36	36	36	37	36	36	36	35	38

[a] The subjects of steam boilers, hoisting machines, steam engines, and hydraulic motors are considered together.

SCHOOL OF MACHINERY CONSTRUCTION, DORTMUND, PRUSSIA.

This school is conducted in connection with the Superior School of Machinery Construction mentioned under the class of secondary or intermediate technical schools. Both schools occupy the same buildings, which were erected in 1896 and 1897 at a cost of 700,000 marks ($166,600). The purpose of the school is to afford persons aspiring to become foremen, superintendents, and manufacturers the technical knowledge and skill in drawing which is necessary in such occupations.

The course covers four half-year terms, each term lasting on an average twenty weeks of forty-two hours each. Candidates for admission must have had four years' practical experience and a sufficient general education. They are admitted twice a year, at the beginning of April and of October. The tuition fee is 60 marks ($14.28) per year, payable quarterly. A charge of 1.50 marks (36 cents) is made semiannually for accident insurance. An examination fee of 10 marks ($2.38) is charged at the close of the course. Stipends and scholarships are granted to needy pupils in meritorious cases.

The following table shows the hours per week devoted to each study, according to the programme published in 1901:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, SCHOOL OF MACHINERY CONSTRUCTION, DORTMUND.

Subjects taught.	Hours per week.			
	First half year.	Second half year.	Third half year.	Fourth half year.
German language	5	3		
Industrial law			2	
Arithmetic	5	2		
Mathematics	7	6	5	2
Experimental physics	4	2		
Experimental chemistry	2			
Mechanics		5	5	2
Theory of machinery		6		
Theory of steam boilers and hoisting machines			7	
Steam engines and hydraulic and small motors				8
Electro-technics		4	3	3
Technology of mechanics and smelting and refining		2	6	4
Theory of building construction			2	2
Estimating wages				
Drawing	17			
Machinery drawing		10	8	14
Projection drawing		2		
Descriptive geometry				
Bookkeeping				3
Penmanship (engrossing)	1			
Practice in the workshop for machinery construction			4	4
First aid to the injured	1			
Total hours	42	42	42	42

In addition to the day school there is an evening and Sunday continuation school connected with this institution, which is intended for journeymen and apprentices in the metal trades. The instruction consists of theoretical work and drawing. Persons graduated from this evening and Sunday school are eligible to enter the second half-year class of the day school. The evening and Sunday school is in session four work-day evenings each week from 8 to 9.45 and on Sundays from 8 to 10 a m. The tuition is 10 marks ($2.38) per half-year term.

ROYAL SCHOOL OF MACHINERY CONSTRUCTION, CHEMNITZ, SAXONY.

This school was established in 1855 as one of the State technical schools of Chemnitz, and originally educated only mechanics, such as machinists, spinners, weavers, paper makers, etc. In 1869 there was added a department for bleachers and dyers, in 1880 one for millers, in 1885 one for soap makers, and in 1892 one for electricians. The department of technical mechanics and that of electro-technics constitute the school proper, the others being secondary in importance. The course of study in these two departments covers three and four terms, respectively. The aim of the school is not to attempt, in the short space of time allotted to each course, to impart profound scientific instruction, but to furnish to the pupils such knowledge of a practical nature as may be needed for the intelligent exercise of their

respective vocations. Only those who have had a practical experience of three years' duration in their chosen line of work are eligible for admission. Machinists are advised to serve this apprenticeship, whenever possible, in the shops of some important establishment. For electricians it is necessary to have worked in some reliable establishment for the manufacture of telegraphic apparatus or electrical machines of some kind. In addition, pupils must be at least 15 years of age, they must be able to read and write, and they must possess a knowledge of arithmetic as far as decimal fractions.

The programme of work comprises an obligatory theoretical course of thirty-two hours per week on an average, and optional courses, practical in character, for pupils pursuing studies in special branches. In the department for dyers the course embraces three terms. To be admitted to this department pupils must be 15 years of age and have worked at their trade not less than one and a half years. They must also be able to read, write, and perform simple mathematical calculations.

The number of pupils attending the several departments of the school on December 1, 1899, was as follows: Department for mechanics, 154; department for dyers, 22; department for electricians, 35; total, 211.

Of this number, 153 were natives of Saxony, 49 of other German States, while 9 were foreigners.

The tuition fee per term is 30 marks ($7.14). Pupils of small means who show themselves capable and industrious may secure a reduction of the tuition rates. Since its establishment the school has matriculated approximately 4,700 students.

Upon the completion of the course pupils receive diplomas showing the averages obtained each year and in the final examination. Besides medals and certificates of merit, money prizes are awarded to pupils who have distinguished themselves in their work.

THE TECHNIKUM, HAMBURG.

This institution, which forms part of the State industrial school system of Hamburg, was organized in 1895. It comprises the following four distinct divisions: A superior school for machinery construction, a superior school for shipbuilding, a superior school of electrotechnics, and a school for steamship machinery construction.

The purpose of the first three schools is to offer men who have had suitable experience in a machine shop, dockyard, etc., a course of instruction of a theoretical character that will qualify them for positions as managers, foremen, assistants in construction bureaus, etc., in their respective fields. The fourth school is intended for those who, having both practical and theoretical training in general machinery

construction, desire to take an advanced course in theoretical instruction relating to steamship machinery construction that will qualify them to become constructors and inspectors of steamship machinery.

The courses of instruction are arranged in half-year terms, the first three schools requiring four half-year terms and the fourth school two half-year terms for a complete course. The hours of instruction are from 8 a. m. to 12 m., and from 2 to 5 p. m.

Applicants for admission to the first three schools must produce evidence of sufficient practical training in their particular branch, and be prepared to pass an entrance examination in arithmetic, plane geometry, elementary algebra, composition, and elementary drawing. The fourth school is open to those who have satisfactorily completed the full courses of the superior school for machinery construction, the superior school for shipbuilding, or the superior school of electro-technics. Tuition is 72 marks ($17.14) per term, payable upon the entrance of the student.

Frequent excursions to machine shops, electric plants, ships, and dock yards under the guidance of the instructors of the institution afford opportunities for practical observation and investigation in the subjects in which the students are especially interested.

The following programme shows the studies pursued at each school, with the number of hours per week devoted to each:

SUPERIOR SCHOOL FOR MACHINERY CONSTRUCTION.

First term: German, 2; algebra, 3; plane geometry, 1; stereometry, 2; trigonometry, 2; mathematical exercises, 3; mechanics, 3; chemistry, 2; physics, 3; descriptive geometry, 9; machinery, 10; building construction, 2.

Second term: German, 2; algebra, 3; analytical geometry, 3; mathematical exercises, 2; mechanics, 6; chemistry, 2; physics, 3; descriptive geometry, 4; machinery, 15; building construction, 2.

Third term: German, 2; mathematical exercises, 2; mechanics, 4; chemistry, 1; physics, 1; electro-technics, 3; technology, 3; steam engines, 9; lifting machines and pumps, 11; boilers and furnaces, 6; practical geometry, 2; emergency relief in case of accidents, with practical exercises, 1.

Fourth term: Mathematical exercises, 2; mechanics, 3; chemistry, 1; physics, 1; electro-technics, 2; technology, 4; steam engines, 16; lifting machines and pumps, 2; water motors and small motors, 4; boilers and furnaces, 5; estimates of machinery construction; 2.

Following is a synopsis of such of the foregoing subjects as are of special interest:

Machinery: Theory of the various parts of machines, as axles, cylinders, friction wheels, cog wheels, belting and gearing, cranks, eccentrics, connecting rods, cross-bars, etc.; sketching and drawing of the foregoing; elementary problems in machinery designing.

Steam engines: The various classes of steam engines; valve motion; diagrams; structure of the various parts; fly wheels; regulators; reversing cylinders; compound steam engines; design of a steam engine and its various parts.

Lifting machines and pumps: Cables, chains, rollers, hooks, blocks and pulleys, brakes, ratchets, cranes, piston pumps, centrifugal pumps, etc.; designing of lifting machines and pumps in connection with the lectures.

Boilers and furnaces: Fuel, combustion, the principal methods of firing and their efficiency; transmission of heat; chimneys; the most important systems of boilers; the armature, embedding, and tending of boilers; the laws of steam boilers; construction of boilers.

Water motors and small motors: Water wheels and turbines; gas, benzine, petroleum, and hot-air motors.

SUPERIOR SCHOOL FOR SHIPBUILDING.

First term: German, 2; algebra, 3; plane geometry, 1; trigonometry, 2; stereometry, 2; mathematical exercises, 3; mechanics, 3; chemistry, 2; physics and electro-technics, 3; descriptive geometry, 9; machines, 6; ship drawing, 4; practical shipbuilding, 2.

Second term: German, 2; algebraic analysis, 3; analytical geometry, 3; mathematical exercises, 2; mechanics, 5; chemistry, 2; physics and electro-technics, 3; descriptive geometry, 4; machines, 4; ship drawing, 5; theoretical shipbuilding, 4; practical shipbuilding, 5.

Third term: German, 2; mathematical exercises, 2; mechanics, 3; physics and electro-technics, 3; technology, 2; machines, 4; ship drawing, 7; theoretical shipbuilding, 2; practical shipbuilding, 12; arrangement and equipment of ships, 4; emergency relief in case of accidents, with practical exercises, 1.

Fourth term: Mathematical exercises, 2; mechanics, 2; physics and electro-technics, 1; technology, 3; ship drawing, 9; theoretical shipbuilding, 2; practical shipbuilding, 12; arrangement and equipment of ships, 2; naval architecture, 4; steamship machinery, 5.

Following is a synopsis of such of the foregoing subjects as are of special interest:

Ship drawing: Making of tracings to accustom students to the use of the necessary wood curves in ship drawing; drawing of ships according to given data; designing of ships based upon given conditions and upon previous theoretical studies.

Practical shipbuilding: Studies of the principal parts, of the materials used in construction, and of the customary connecting parts of ships; making drawings of simple parts of a ship from measurements, sketches and plans, etc.; introduction to the application of the regulations of the German Lloyd and the Veritas office; the working out of the ship's frame according to the foregoing regulations; drawing of longitudinal sections, decks; working plans, etc.

Theoretical shipbuilding: Lectures on the principal methods of measurements; the forms of the various types of ships; calculating the displacement, tonnage, stability, specific gravity, and the center of gravity of ships; the speed and steering of ships.

Arrangements and equipment of ships: Cabin and deck arrangements; apparatus for extinguishing fire; arrangements for loading, ventilation, heating, etc.; masts, rigging, and sails; laws relating to this subject.

Naval architecture: A brief survey of the development of naval architecture; armor plates; special equipment for war vessels.

Steamship machinery: Description of the boilers and machinery and the necessary arrangements for placing them on ships; form and size of ships' screws and wheels.

SUPERIOR SCHOOL OF ELECTRO-TECHNICS.

First term: German, 2; algebra, 3; plane geometry, 1; trigonometry, 2; stereometry, 2; mathematical exercises, 3; mechanics, 3; chemistry, 2; physics, 3; electricity, 2; descriptive geometry, 9; machines, 8; building construction, 2.

Second term: German, 2; Algebraic analysis, 3; analytical geometry, 3; mathematical exercises, 2; mechanics, 5; chemistry, 2; physics, 3; electricity, 2; descriptive geometry, 4; machines, 11; technics of weaker currents, 2; accumulators, 1; building construction, 2.

Third term: German, 2; mathematical exercises, 2; mechanics, 3; chemistry, 2; physics, 1; electricity, 2; technology, 2; machines, 7; steam engines, 2; boilers and furnaces, 2; technics of stronger currents, 6; instruments and measurements, 4; emergency relief in case of accidents, 1; laboratory, 6.

Fourth term: Mathematical exercises, 2; mechanics, 2; chemistry, 1; electro-technics, 4; physics, 1; technology, 3; steam engines, 3; boilers and furnaces, 2; water motors and small motors, 2; technics of stronger currents, 4; distribution of currents, 4; instruments and measurements, 2; electrical machines, 6; laboratory, 6.

Following is a synopsis of such of the foregoing subjects as are of special interest:

Electricity: Magnetism; terrestrial magnetism; frictional electricity; galvanic electricity; resistance; Ohm's law; distribution of currents; physical effects of the electric current; thermal electricity; Ampere's theory of magnetism; induction; introduction to the theory of alternate currents.

Technics of weaker currents: House telegraphy; telephony; telegraphy; cable communication; electric clocks and signaling apparatus; electric fire alarm, etc.

Accumulators: General description; construction; management; arrangement in batteries; unipolar cells, etc.

Technics of stronger currents: Theory of the lines of force; theory of induction; theory of capacity; development of continuous currents; characteristics; switches; continuous-current motors; arc lamps; incandescent lamps; Nernst lamps; electric heating; theory of alternate currents; single and multiphase generators; transformers; electric railroads, cranes, boats, and automobiles.

Distribution of currents: Systems of distribution for continuous and alternate currents; distribution of currents on ships.

Instruments and measurements: Measurements of resistance, currents, tension, etc.; galvanometers; accumulators; amperemeters; photometry; magnetic measurements; determining coefficients of capacity and induction; special measurements of alternate-current systems, etc.; lightning rods.

Electro-chemistry, with practical exercises in the laboratory: Theory of electrolysis and its application; galvanoplastics; metallurgy; galvanic elements and accumulators.

Electrical machines: Estimates and construction of simple apparatus; continuous-current machines; transformers; designing of switches and switch boards.

Laboratory: Practical exercises based upon the lectures on instruments and measurements, etc.

SCHOOL FOR STEAMSHIP MACHINERY CONSTRUCTION.

First term: Differential calculus, 4; mathematical exercises, 4; steamship machinery, 6; steamship boilers, 4; shipbuilding, 3; designing of steamship machinery, 15; theory of mechanical heat, 2; electro-technics, 4.

Second term: Integral calculus, 4; mathematical exercises, 4; analytical mechanics, 4; theory of machinery, 2; steamship machinery, 6; steamship boilers, 2; designing of steamship machinery, 15; shipbuilding, 3; electro-technics, 2.

Following is a synopsis of such of the foregoing subjects as are of special interest:

Steamship machinery: Theory of the marine engine; steam cylinders; consumption of steam; single, double, triple, and quadruple expansion engines; estimates for designing an engine; designing of steam cylinders and pistons; valves; transmission of power; cross-head guides; connecting rods; engine beams; shafts; tests of condensers, pumps, injectors, pulsometers; foundation for steamship machinery; installation of steamship machinery; paddle wheel and screw; pilot engines; machines for weighing the anchor; sea-water still; ventilators; fire extinguishers and loading apparatus; management of machinery on ships; damages and repairs.

Steamship boilers: Kinds and properties of fuel; combustion; use of burning fluids in ship boilers; storing and watching fuel on ships; types of steam boilers, cylindrical, locomotive, tubular, etc.; the strength of boiler material; strength of walls,

riveting, fastenings; furnace; artificial draft; equipment of boilers; overheating, etc.; regulations regarding the installation, inspection, and management of boilers; regulations of the German and English Lloyd and the Veritas office regarding the construction of marine engines and boilers.

Shipbuilding: Practical shipbuilding—construction and equipment of steamships; precautionary measures on steamships; water-tight doors and bulkheads; double floors, pumps, fire extinguishers; hygienic measures on ships; ventilation and heating; foundations for machinery and boilers; steering apparatus. Theoretical shipbuilding—calculation of displacement, the center of gravity, and the metacenter; calculation of leakage, strength, and stability; determining the resistance to motion and the efficiency of machinery; resistance of the ship; theory of displacement; the curves of resistance; the helm.

Designing of steamship machinery: Designing of boilers and of separate parts of a marine engine; designing of an engine in all its parts.

Electro-technics: The principal laws of electro-magnetism and induction with special reference to their application to electrical machines; principles of electrical machines for continuous currents; the armature; the magnetic field and reaction of induced currents; description of electrical machinery commonly used on ships; meters, their use and application, etc.; electric bells, electric-lighting plants for ships; theory of dynamos; alternate-current machines; transmission of electric power and its application on ships; electro-motors for continuous and alternate-current transformers; accumulators; electrical apparatus for transmission of orders on ships.

The following table shows the number of students in attendance at this institution during the school year 1900–01:

NUMBER AND OCCUPATIONS OF STUDENTS ATTENDING THE TECHNIKUM, HAMBURG, 1900–01.

Occupations.	Summer.	Winter.
Machine constructors	68	73
Marine machine constructors and marine machinists	3	13
Shipbuilders	18	24
Electricians	28	34
Total	117	144

SCHOOLS FOR THE BUILDING TRADES.

For reasons explained in the early part of this chapter, this class of trade schools is considered separately. While there are over fifty building-trades schools in the German Empire, their plan of organization, object, and courses of study are so similar that a description of a few of the most important will serve to give a fair idea of them all. The schools selected for detailed description are those in Berlin, Prussia; Munich, Bavaria; and Zittau, Saxony.

SCHOOL FOR THE BUILDING TRADES, BERLIN, PRUSSIA.

This is a day school intended for the training of builders and of foremen in the various building trades. It is governed by a board composed of officials of the city and State governments and of representative citizens. The school was founded in 1878 by the Artisans' Association (*Handwerkerverein*) and in 1883 became a municipal institution.

The courses of instruction are arranged in four terms of twenty weeks each, thus requiring two years for the completion of the full course. Following is a statement showing the distribution of hours of instruction:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH SCHOOL FOR THE BUILDING TRADES, BERLIN.

Subjects taught.	Hours per week.				
	First half year.	Second half year.	Third half year.	Fourth half year.	Total.
German language	2				2
Arithmetic	3				3
Algebra	4	4			8
Geometry, trigonometry	4	5			9
Mathematical exercises			2	2	4
Natural science		3	3	2	8
Surveying, leveling			2		2
Building materials	2			2	4
Statics, mechanics		4	3	4	11
Descriptive geometry	10	4	4	3	21
Building construction	13	15	12	7	47
Architecture		3	4	6	13
Designs for buildings			10	12	22
Architectural forms	4	6	6	4	20
Free-hand drawing	6	4			10
Building regulations				2	2
Estimates			2	2	4
Bookkeeping				2	2
Total hours	48	48	48	48	192

The following is a synopsis of the subjects taught as far as they relate to the building trades:

First half-year term: Building materials—natural building materials, procuring and working the same; artificial materials and their production. Building construction—(1) stonework: bondings for artificial and natural stones; walks; corners; crossings; columns, insulation, chimneys, door and window openings; wall and transverse arches, their erection and bracing; arch forms; floors and pavings; (2) woodwork: wood joining; joist work; timberwork; partitions; cogged and pegged beams; truss and suspension work; board and timber walls; floors. Architectural forms—casings; moldings in stone, brick, and wood. Freehand drawing—drawing from plain wood and gypsum models. Modeling (optional).

Second half-year term: Building construction—(1) stonework: arches, cylindrical, gothic, cross, even surfaced, cupola and hemispherical, surbased spherical, inflected lunettes; scaffolding; (2) woodwork: forms of roofs, trusses, and rafters; beams, shingles, and timbers for roofing; roof coverings and spouting. Architecture—introduction to planning of simple buildings and to the most important hygienic and legal regulations. Forms—full explanation of casings and moldings; forms for walls; columns and pillars; façades; working plans. Freehand drawing—simple ornaments and parts of buildings. Modeling (optional)—stone and wood construction.

Third half-year term: Strength of materials—resistance and elasticity; strains and pressure; bending, cutting, etc. Construction—stairs; carpenters', locksmiths', glaziers', and painters' work; ironwork; connection of iron parts, bracing of beams, etc.; columns. Architecture—(1) simple city and rural dwellings; (2) agricultural structures: barns, storehouses, elevators, stables; (3) industrial structures: breweries, distilleries, forges. Plans—designs for simple city and rural buildings; preparation of plans. Architectural forms—Renaissance columns; exercises in designs and details of brick and stone buildings. Estimates—reckoning of costs of materials; estimates of a design prepared by the student; explanation of the same. Surveying

and leveling—use of the more important instruments; exercises in surveying and plotting plans and projections. Modeling—stone and wood work.

Fourth half-year term: Building materials—elements of chemistry; hydrogen, oxygen, carbon, and chlorine; chemical properties and action of building materials; testing processes. Statics and theory of resistance—analytic and graphic treatment of supports; theory of arches and retaining walls. Building construction—ironwork, sheet and box beams, etc.; roof construction; properties, investigation, and strength of foundations; foundation work, choice of methods of procedure. Architecture—dwellings, country houses and villas; city dwellings and business structures; hotels; rural schoolhouses and smaller public buildings; heating and ventilation; water supply and drainage; lighting arrangements. Designs—plans for larger city houses for dwelling and business purposes, with special reference to local conditions; preparation of working drawings. Forms—characteristics of the architectural styles; brief sketch of their development. Regulations—general legal requirements and specifications; the Berlin building laws; most important features of the national industrial laws and workingmen's insurance laws. Estimates for and management of operations—requisites of plans and specifications; making contracts; supervising operations; preparing reports and estimates, keeping accounts of work performed, etc. Bookkeeping—opening accounts and keeping the books of a building enterprise; business forms and regulations; law relating to bills of exchange. "Samaritan" course—anatomy of the human body; first aid to the injured in accident cases.

Applicants for admission to the lowest class must be 16 years of age, must have had twelve months' practical experience in their trade, must be able to spell, and must have a knowledge of elementary arithmetic and geometry. A school certificate or an examination is required as evidence of the candidate's possession of these qualifications.

Students of the highest class who have passed the examination prescribed by the royal examining commission receive a certificate to that effect.

The instruction is given by a director, 37 teachers, and 1 physician. Of the instructors in 1899, 19 were practical men (*techniker*), 14 professional teachers, 3 painters, and 1 a sculptor. The number of students in attendance during the academic year 1899–1900 was 390, divided into four grades, each grade having four classes doing similar work. The number and occupations of the students and the classes they attended are as follows:

NUMBER AND OCCUPATIONS OF STUDENTS ATTENDING SCHOOL FOR THE BUILDING TRADES, BERLIN, 1899–1900.

Occupations.	First half-year term.	Second half-year term.	Third half-year term.	Fourth half-year term.
Masons:				
Journeymen	38	46	52	64
Apprentices	69	31	18	.....
Carpenters:				
Journeymen	6	19	13	14
Apprentices	7	7	3	.....
Stonecutters	1	2	.....	.....
Total	121	105	86	78

Of these 390 students 240 were residents of Berlin, 130 came from other parts of Prussia, 17 were from other German States, and 3 were

foreigners. Eighty-four applicants were turned away at the beginning of the winter term of 1899, because of lack of accommodations.

Each class taking the course in surveying was given five excursions of four hours each for practical demonstrations. Three scientific excursions of two days each were given to 63 of the pupils under the supervision of the instructors.

The tuition fee is 100 marks ($23.80) per term. In the year 1899–1900 free tuition was given to 11 students, while 54 had one-half the fee remitted.

The school building is provided by the city, which also defrays the cost of heating and lighting. All other expenses not covered by the receipts of the school are divided equally between the city and the State governments. In 1898–99, the latest year for which the figures are available, the expense incurred for the school was 90,862 marks ($21,625); the receipts from tuition fees were 34,490 marks ($8,187); miscellaneous income, 812 marks ($193), leaving 55,650 marks ($13,245) for the city and State to supply.

SCHOOL FOR THE BUILDING TRADES, MUNICH, BAVARIA.

This school is an annex of the State Industrial School at Munich and is intended as a continuation school for persons engaged in the building trades. It offers instruction especially to masons, stonecutters, and carpenters in those technical branches which will better qualify them to practice their trades as master workmen. The school is in session only five months of the year, from the beginning of November to the end of March, thus affording the students an opportunity to work at their trades during the busy season.

Applicants for admission to the lowest grade must have attained the age of 16 years, satisfactorily passed the common school requirements, worked at a trade for two years, and present a certificate of good moral character. Applicants may be admitted to an advanced class, provided they can give evidence that they are sufficiently qualified.

The entrance fee is 1 mark (24 cents) and tuition fee 30 marks ($7.14) per term, the latter sum payable in two equal installments, at the beginning of November and January. Tuition fees may be remitted in cases of students in needy circumstances. During the school year 1900–01 the tuition fee was thus remitted to 51 students, and scholarships derived from various funds were granted to 55 students to the amount of 4,296 marks ($1,022).

During the school year 1900–01 the faculty of the school consisted of the director, 4 permanent instructors, 9 instructors regularly connected with the industrial school, and 6 special instructors.

The following is a programme of the course of studies, with the number of hours per week devoted to each:

First term—German, 4; arithmetic, 4; physics, 2; plane géometry with linear drawing and elements of projections, 13; free-hand drawing, 8; architecture and architectural drawing, 20; penmanship, 3.

Second term—German, 4; industrial bookkeeping, 2; physics, 2; algebra, 4; stereometry, with descriptive geometry and shadows, 9; free-hand drawing, 8; architecture, 14; architectural forms, 4; stonecutting, 6; penmanship, 1.

Third term—German, 2; mathematics, 5; surveying, 2; mechanics, 4; chemistry and building materials, 3; architecture, 21; perspective, 4; stonecutting with exercises in modeling, 4; architectural forms, 8; building regulations, 1.

Fourth term—Mechanics, 5; machinery and mechanical technology, 2; chemistry, 3; architecture, 28; style, 2; bridges, roads, and waterworks, 12; surveying, 2.

Following is a synopsis of the foregoing subjects which pertain to the building trades:

Mechanics: Statics with reference to building construction; elements of machinery.

Machinery and mechanical technology: Machinery employed in the working of stone, wood, and iron; lifting machines; pumps; transporting machines; presses; machines used in making mortar; the most important machines used in technical trades.

Chemistry and building materials: General chemistry and technology so far as they are important to the builder, with an exhaustive treatment of the materials used in building.

Surveying: Exercises in surveying, with the use of the chain, pole, and leveling instruments; platting and drawing.

Architectural forms: The Roman, Doric, Ionian, and Corinthian orders; disposition of columns; details of doors, windows, and casings; detail drawings; a brief historical sketch of the development of architectural forms with special reference to Greek and Roman styles.

Architecture and architectural drawing: Lectures with practical exercises in drawing, beginning with the simpler forms of structural details, as boundings, pillars, chimneys, arches, and vaults; wood joining, framework, truss and strut frames; construction of roofs, iron construction work; the Tuscan order; followed by an exhaustive treatment of the various operations in masonry, carpentry, iron construction works and heating arrangements; drawing plans for dwelling houses, small public buildings, and agricultural buildings with variations in their interior and exterior construction; building estimates.

Bridges, roads, and waterworks; construction of bridges in stone, wood, and iron; estimates of earthwork; construction of roads, canals, and aqueducts.

The following table shows the number of students in attendance during the school year 1900–01:

NUMBER AND OCCUPATIONS OF STUDENTS ATTENDING SCHOOL FOR THE BUILDING TRADES, MUNICH, 1900-01.

Occupations.	First term.	Second term.	Third term.	Fourth term.	Total.
Masons	47	17	35	19	148
Stonecutters	4	1	3	1	9
Carpenters	5	6	3	8	22
Joiners	4	2	2	4	12
Stucco workers	.....	.....	1	.....	1
Total	60	56	44	32	192

SCHOOL FOR THE BUILDING TRADES AND CIVIL ENGINEERING, ZITTAU, SAXONY.

This institution (*K. Sächsische Baugewerken- und Tiefbauschule*) was established by the Government in 1840 and is under the immediate control and supervision of the Government of Saxony, receiving its

main support from annual State appropriations. It comprises two departments—the school for the building trades and the school for civil engineering, each providing for a two years' course of four half-year terms.

The school for the building trades is intended to provide a systematic course of instruction for the theoretical training of master masons and builders. The school for civil engineering, which was opened October 3, 1898, provides an intermediate grade of instruction for students in the technical features of road construction, waterworks, and railroad building, to supply competent men not only for the State and municipalities, but also for industrial firms, such as road masters, superintendents of waterworks, superintendents of dikes, railway superintendents, office experts, officials for office and other work of such character, railway managers, etc.

The summer term begins on the second Monday after Easter and continues until the latter part of September, with an intermission from the middle of July to the middle of August. The winter term begins in the second week of October and continues until the latter part of March, with an intermission from December 23 to January 6.

The tuition fee for each department is 30 marks ($7.14) per term, payable in advance, but students in needy circumstances who are residents of Saxony may have their tuition fee remitted in whole or in part. During the school year 1898–99 tuition fees were thus remitted to 14 students to the amount of 420 marks ($99.96). During the same year the total sum expended for the maintenance of the school amounted to 42,263 marks ($10,059) and the sum appropriated by the State amounted to 38,672 marks ($9,204).

Each applicant for admission must have a common-school education and at least one year's practical experience in the trade which he intends to follow. In the case of the school for the building trades he must have attained the age of 15 years, and in the school for civil engineering the age of 16 years. The conditions, however, may be modified in so far that an applicant who has received a high-school education may be admitted with a half-year's practical experience.

During the school year 1900–01 the faculty of the school consisted of the director and 16 instructors.

The following is a programme of the courses of study, with the number of hours per week devoted to each:

SCHOOL FOR THE BUILDING TRADES.

First half-year term: General architecture, 4; architectural drawing, 6; free-hand drawing, 6; mathematics, 10; physics, 2; projections, 8; German, 4.

Second half-year term: General architecture, 2; masonry work, 5; carpentry work, 5; business law, 1; architectural drawing, 4; designing, 5; free-hand drawing, 4; mathematics, 4; physics, 2; mechanics, 2; perspective, 2; German, 4.

Third half-year term: Building materials, 2; masonry work, 3; carpentry work, 3; business law, 1; heating and ventilating, 3; designing, 12; free-hand drawing, 3; mathematics, 4; physics, 2; mechanics 4; surveying, leveling, and field sketching, 3; German, 2.

Fourth half-year term: Iron construction work, 4; building plans, 3; building estimates, 4; history of architecture, 2; designing, 16; free-hand drawing, 3; mechanics, 4; perspective, 2; bookkeeping, 2.

Following is a synopsis of the foregoing subjects which pertain to the building trades:

General architecture: Discussion of the separate parts of buildings in general; location, preparatory work, and arrangement of buildings according to their various purposes; dwelling houses, buildings for agricultural purposes, and industrial establishments; foundation work.

Architectural drawing: Lectures and exercises in drawing moldings and casings, windows and doors, the various orders, etc.

Free-hand drawing: Exercises in the training of the hand and eye in outline drawing of plane and relief ornaments from copies and from models; exercises in sketching and drawing from memory; exercises in shadows; designing of ornaments.

Masonry work: Bondings for brick and stone work, walls, pillars, door and window casings, fastening rods, etc.; construction of vaults, including simple bridges; the cut of stones; stairs of stone, brick, and cement; stone and cement floors.

Carpentry work: Materials; framework; floors; framed partitions; joists, rafters, sleepers, supporters, girders, truss frames, etc.; form and construction of roofs, stairs, doors, and windows; scaffolds.

Iron construction work: Materials; connection of constructive parts; simple and compound supporters; construction of ceilings; columns and stanchions; roofs and stairs.

Business law: Discussion and explanation of municipal building regulations; regulations governing fire insurance; sick benefit and accident insurance.

Designing: Preliminary studies in designing by finishing given sketches; plans for dwelling houses, agricultural buildings, and industrial establishments; exercises in working drawings.

SCHOOL FOR CIVIL ENGINEERING.

First half-year term: General architecture, 4; free-hand drawing, 6; mathematics, 10; physics, 2; projections, 8; surveying, 8; German, 4.

Second half-year term: General architecture, 2; masonry work, 4; carpentry work, 4; building regulations, 1; construction of roads, waterworks, and railroads, 4; trade drawing, 6; architectural drawing, 4; free-hand drawing, 4; mathematics, 4; physics, 2; mechanics, 2; German, 4.

Third half-year term: Building materials, 2; iron construction work, 2; business law, 1; elements of machinery, 2; construction of roads, waterworks, and railroads, 4; municipal engineering, 2; bridge building, 2; electro-technics, 2; designing, 10; mathematics, 4; mechanics, 4; surveying, 8; German, 2.

Fourth half-year term: Iron construction work, 2; building estimates, 4; elements of machinery, 2; construction of roads, waterworks, and railroads, 8; municipal engineering, 1; bridge building, 2; electro-technics, 2; designing, 16; mechanics, 4; bookkeeping, 2.

The general studies in the school for civil engineering are identical with those in the school for the building trades.

Surveying: The students are made familiar with the use of the most important apparatus and instruments for horizontal measurements, with practice in testing and correcting these instruments, laying out arcs, methods of surveying plots, methods

of surface computations, vertical measurements, leveling apparatus and instruments, testing and correcting them, and their use; methods of leveling; simple and complex leveling; surveying of plane surfaces, small complex areas, longitudinal and cross profiles; marking out segments; computation of entire areas; representing characteristic features in black and in color; computation and graphic representation of various elevations.

Construction of roads, waterworks, and railroads: A general discussion of the construction of country roads, including proper drainage; construction and maintenance of dams, dikes, and embankments; water supplies for small communities; construction of railroads, the roadbed, breadth, elevation, ditches, grades, blasting, fencing, protective measures against snow, crossing bridges; general remarks on track construction, material, ties, rails, fastenings, bedding; construction of switches and crossings, simple and complex positions, turntables, sliding platforms, cranes, platform scales, location and arrangement of stations in general, buildings, platforms, etc.; signal systems, block stations, central stations, railroad regulations, etc.

Trade drawing and designing: Measuring scales; profiles of locks, street and steam railroads; wooden, stone, and iron bridges; culverts; locks and dams; railroad buildings; street crossings; freight stations; small railroad depots; plain warehouses and factory buildings.

Architectural drawing: Moldings and casings, doors and windows; drawing piers, breastworks, portals, and other objects discussed in the lectures on building constructions.

Mechanics: Composition and resolution of forces; gravity; computation of wood, stone, and iron construction work; mechanical powers; solution of problems; review of the most important sections of statics; determining the strength of truss and strut frames, framework for roofs, bridges, vaults, retaining walls, and pillars.

Municipal engineering: Location of streets and squares, platting longitudinal and cross profiles; grading and paving of streets and sidewalks, draining and cleaning; sewerage; conduits for gas, water, and electricity; street railways.

Electro-technics: The essentials of frictional electricity; the phenomena and laws of galvanic electricity; electric currents, with special reference to municipal engineering.

The following table shows the number of students in attendance during the school year 1900–01:

NUMBER OF STUDENTS ATTENDING SCHOOLS FOR THE BUILDING TRADES AND CIVIL ENGINEERING, ZITTAU, 1900–01.

Classes.	Beginning of winter half year, 1900–01.	Close of winter half year, 1900–01.	Beginning of summer half year, 1900–01.	Close of summer half year, 1901.
SCHOOL FOR THE BUILDING TRADES.				
First-term class	26	25	11	9
Second-term class	29	28	10	9
Third-term class	22	22	21	20
Fourth-term class	18	18	7	7
Total	95	93	49	45
SCHOOL FOR CIVIL ENGINEERING.				
First-term class	24	24	5	4
Second-term class	19	18	11	11
Third-term class	14	14	11	11
Fourth-term class	6	6	6	6
Total	63	62	33	32

SCHOOLS FOR THE TEXTILE TRADES.

These schools, like those for the building trades, have been considered separately in the classification of German industrial schools. Of the textile schools, some are of a higher, others of a lower grade; some relate only to weaving, while others include one or more other branches of the textile industry. In the selection of the schools for detailed description, those have been taken which offer the widest range in their courses of instruction, that is, schools which give both the higher and lower grades of instruction in weaving, spinning, dyeing, and other textile branches. The schools selected are the textile schools in Aix-la-Chapelle, Berlin, and Crefeld, Prussia, and Reutlingen, Wurttemberg.

SCHOOL FOR THE TEXTILE TRADES, AIX-LA-CHAPELLE, PRUSSIA.

The origin of the Aix-la-Chapelle school was due to private initiative. It was established in 1883 by a number of persons for the purpose of advancing the textile industry of the city. For the first eight years of its history no aid was received from the Government. As the school increased in importance a change in location became necessary. In making this change the city gave the ground for a new building, and the Association for the Advancement of Industry of Aix-la-Chapelle gave in the neighborhood of $75,000 toward the construction of the building. Since then the association has continued its contributions, and the school also profits from other benefactions. Both the city and the State contribute to the support of the school in addition to having paid a large sum for its equipment.

The school is intended to give instruction in all the branches of the textile industry.

From a technical standpoint the school is of interest for the reason that, more than in almost any other institution, the effort is made to carry on actual productive operations in the shops belonging to the school. The shops in fact are run much as an ordinary commercial enterprise. Orders for weaving are executed, and products sold when possible. The instruction given is thus thoroughly practical. The foremen who give the instruction in the school shops also have under them ordinary workmen who are paid wages in order that the commercial orders may be promptly and properly executed. The dyeing shops were formerly run on the same plan, but as the financial results were unsatisfactory the system was abandoned. The same difficulty is found in the case of the weaving shops, but as the system is believed to be advantageous to the pupils it is maintained notwithstanding the financial loss.

As regards equipment the school is provided with all the necessary workrooms, laboratories, machines, etc. The scheme of instruction includes five courses, two of which relate to weaving and spinning,

one to dyeing, one to finishing, and one to darning. All the operations of the woolen industry are thus covered.

The darning course is the only one of its kind in Germany. It is organized on an elaborate scale and executes important orders from private parties. The students of this course are women and girls over 14 years of age. They can remain at the school as long as they desire and are paid wages according to the value of the work done by them. It is thus a true apprenticeship shop.

The other courses are attended by young men only. The day weaving course covers two terms. In general, the courses are shorter than elsewhere in superior textile schools. The evening weaving course which is intended for foremen and workmen is of longer duration, namely four terms, as not more than 10 hours a week can be devoted to education by the workingmen, while 44 hours a week are given in the day course for employers and directors. The course in dyeing is two years and that in finishing is one term. These courses are often followed by students who have finished the weaving course.

The tuition fee is from 200 marks ($47.60) to 800 marks ($190) a year according to whether the student is a Prussian, a native of another German State, or a foreigner. For the evening course in weaving the fee is 30 marks ($7.14) a year.

The number of students enrolled during the year 1895–96 was as follows:

Weaving (day course)	47
Weaving (night course)	124
Dyeing	7
Finishing	11
Darning (*rentrayage*)	72

There were 9 professors and 9 assistants.

SCHOOL FOR THE TEXTILE TRADES, BERLIN, PRUSSIA.

This school was established in 1875 by the union of trade guilds and employers of the city. These bodies still continue to contribute to its support, although the school is now practically a State institution. Originally only primary instruction was imparted, but the standard has been gradually raised, until at present the highest technical training in weaving is given.

The instruction is specialized in the direction of wool weaving, especially of cloths for wearing apparel, tapestry, etc.

The school has four large shops; the first, for handlooms, is the best equipped; the others are for ordinary power looms, passementerie making, and embroidery. The instruction is divided into two divisions which are almost separate schools, though use is made of the same workshops by classes in both, and certain special courses are given for persons intending to become teachers or designers.

The two divisions consist of day courses, which are intended for persons expecting to become employers or directors of textile establishments and designers, and of evening and Sunday courses for foremen, workmen, and apprentices. To be admitted to either division, students must be 16 years of age and must have already been actually engaged in the textile industry. It is also the general rule that candidates for the day courses shall have completed their secondary education. The school does not aim to replace the practical training required in the shop, but rather to supplement such training.

The courses of studies vary in length from one to two years. Thus in the day classes the course in weaving is either a year or a year and a half according as it relates to the manufacture of cloth or of upholstery goods. The course in designing is two years; the courses in knitting, passementerie making, and dyeing, are one year each; the course for embroidery is one quarter of a year. Each year includes instruction for 42 weeks of 44 hours each. In the courses given in the evenings and on Sunday mornings the mercantile course is one year of 6 hours per week, that for dyeing, two years of 6 hours per week, and that for weaving, passementerie making, and knitting, 8 hours per week for several years, according to the time the pupils can devote to their education.

Most of the students register for all the courses of their division. They can, however, take only a single course or as many as they have time for. The length of instruction is reduced as far as possible, and the greatest possible freedom is given to the students to take little or much, as they are able, in order that all classes of workingmen may be appealed to.

In addition to the two regular courses special courses are arranged for those persons who desire to become teachers or practical designers. For the first of these two classes special attention is given to drawing. The courses for the second class are intended for students who have attended the school of industrial arts and, having obtained a general training there, desire to specialize still further in the trade in which they expect to exercise their abilities.

Following are the subjects taught and the hours per week devoted to each in the day division:

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, COURSE FOR MANUFACTURERS AND FACTORY SUPERINTENDENTS, SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.		
	First half year.	Second half year.	Third half year.[a]
Theory of weaving	6	6	.....
Design transferring	12	12	14
Materials	2	.....	.....

[a] The third half year is intended only for students preparing for the cover, furniture tapestry, and carpet making industries.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE FOR MANUFACTURERS AND FACTORY SUPERINTENDENTS, ETC.—Concluded.

Subjects.	Hours per week.		
	First half year.	Second half year.	Third half year.[a]
Machinery:			
Handlooms	2		
Motors	2		
Preparing apparatus		2	
Finishing apparatus		2	2
Power looms		4	2
Practical exercises	9	8	8
Drawing:			
Free-hand	2	2	14
Mechanical	3	3	
Arithmetic and bookkeeping	3	2	
Dyeing	2	2	2
Jurisprudence	1	1	
Quiz classes			2
Total	44	44	44

[a] The third half year is intended only for students preparing for the cover, furniture tapestry, and carpet making industries.

Following is a synopsis of the subjects taught:

Theory of weaving: Definition and classification of weaving; weaving with one chain and one shot; other classes of weaving; influence of the color and twist of the yarn on the appearance of the woven fabric; application of the various kinds of weaving processes to different classes of tissues.

Design transferring: Characteristics of warp and weft; specification of the weaving process, of the order of colors, of the treadle arrangement, of the fixing and arrangement of the loom; determining the nature of the woven materials and the size of the yarn; calculations.

Materials: Origin, production, and properties of the raw materials; main sources and markets; commercial usages concerning purchase and sale; working the raw materials as far as the finished yarn; utilizing yarns; determining the strength, elasticity, twist, dampness, etc.

Machinery: Handloom weaving—preparing the yarn for weaving and the apparatus pertaining thereto; general construction and arrangement of a loom and disposition of the various parts; card looms, and punching the cards for the same; Jacquard looms and cards; other features of looms. Motors—Definition of power, work, capacity, friction, resultant of forces, lever, rollers, wheel and axle, screw, parts of machines, transmission, wheels, cranks, etc.; water wheels, turbines, steam engines, hot-air engines, explosion engines, electric motors. Apparatus for preparing material—Apparatus for preparing the warp and the weft; apparatus for warping, spooling, cutting, sizing, etc.; twisting machines. Power looms—Description of a typical loom used in the manufacture of woolen and part woolen goods; general review of the mechanism of the various looms; productive capacity, power required, and size of the various looms. Finishing apparatus—Finishing apparatus and processes of finishing used in the various branches of the industry, especially those taught at the school. Practical exercises—Preliminary work; setting up a hand and a power loom; weaving of samples; repair work; motors.

Drawing: Drawing from wood and plaster models in outline and with shading; drawing from sketches and materials; exercises in combining colors, designing of simple patterns from a given motive.

Mechanical drawing: Work with drawing instruments, ruler, triangle, etc.; elements of projection, sketches of parts of machines, working plans.

Technical arithmetic and bookkeeping: Review of arithmetic, brief commercial arithmetic; warp and weft calculations for tissues with one and with several colors and with various sizes of yarns; calculations for the various processes with Jacquard looms; cost of goods; fixing of prices; arrangement and keeping of books of an establishment, such as yarn and stock books, design books, order books, etc.; mercantile bookkeeping is also taught according to the needs of the students.

Dyeing: Dyeing raw materials, skeins, pieces; the most important dyestuffs; testing colors (whether they are fast); brief description of the dyeing and printing processes; discussion of the most important machines used in dyeing and printing.

Jurisprudence: Important features of the industrial code; relations of factory workers, Sunday work, factory inspection, industrial courts, workingmen's insurance; patent system; trade-mark regulations; tariff laws, etc.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE FOR DESIGNERS IN SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.			
	First half year.	Second half year.	Third half year.	Fourth half year.
Technical drawing	22	22	24	24
Theory of weaving	6	6	.....	.....
Design transferring	6	6	a12	a12
Practical exercises at the loom	6	6	a6	a8
Materials	2	.....	.....	.....
Machinery (hand and power looms)	2	4	2	.....
Total	44	44	44	44

a These hours may also be devoted to sketching and other drawing.

The course in technical drawing is as follows:

Drawing from models in outline and in colors; drawing and painting from samples of materials; combining and preparing new designs; drawing and painting from plastic models, combining and designing new samples from plastic motives; drawing and painting from nature.

In addition several of the designs are blocked out and worked up for actual use.

The instruction in the theory of weaving, design transferring, practical exercises, materials, and machinery is the same as in the weaving section.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE FOR KNITTERS IN SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.	
	First half year.	Second half year.
Analysis and production of knit goods	4	4
Practical exercises on the knitting machine	16	16
Theoretical lectures on knitting	2	2
Theory of weaving	6	6
Design transferring	2	4
Materials	2	.....
Machinery	1	2
Practical exercises at the loom	2	2
Arithmetic and bookkeeping	3	2
Drawing	.....	3
Dyeing	2	2
Jurisprudence	1	1
Total	44	44

Following is a synopsis of the courses in two of the above subjects:

Analysis and production of knit goods: Method of producing smooth and pattern mesh goods, tricots, plushes, etc.; practical exercises on the knitting machine; working at and preparing knitting machines and accessory apparatus.

Theoretical lectures on knitting: Description of the various systems of hand and power machines.

The remaining subjects are the same as those in the weaving section.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE IN PASSEMENTERIE MAKING IN SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.	
	First half year.	Second half year.
Theory of weaving	6	6
Design transferring	8	8
Materials	2	
Machinery	4	8
Practical exercises	12	12
Arithmetic and bookkeeping	3	2
Drawing	6	5
Dyeing	2	2
Jurisprudence	1	1
Total	44	44

As will be seen from the foregoing table, the instruction in this course is similar to that given in the weaving section. The practical exercises, however, are devoted to the usual manual work, such as making cords, knots, tassels, etc., and work on passementerie, lace, crocheting, braiding, and chenille machines, etc.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE FOR DYERS IN SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.	
	First half year.	Second half year.
Chemistry and physics	4	4
Chemistry of fibers	2	2
Dyeing and chemical work in the laboratory	33	33
Elements of weaving	2	2
Machinery	2	2
Jurisprudence	1	1
Total	44	44

Following is a synopsis of the courses:

Chemistry and physics: Inorganic chemistry, with special reference to dyestuffs; brief sketch of organic and analytic chemistry; heat, light, and electricity.

Chemistry of fibers: Fibers, their chemical and physical properties; washing, bleaching, coloring matters, mordants, etc.; dyeing machinery.

Dyeing and chemical work in the laboratory: Study of dyeing materials by means of experiments; testing the durability of colors in fabrics, etc.

Spinning and weaving: Study of fibers and yarns and simple textures; their identification when dyed; work at the loom, etc.

Machinery and jurisprudence, the same as in the weaving section.

The subjects taught in the mercantile course of the evening and Sunday division include, for each of the two half-year terms, description of goods, instruction being given on Sundays from 9 to 11 a. m.; pattern designing, given on Sundays from 11 a. m. to 1 p. m.; and practical exercises in weaving, given on Mondays and Thursdays from 8 to 10 p. m.

Lectures are given on the following subjects:

Description of materials: Raw materials; description of the various fibers used in spinning, their source and processes of production; separating and cleansing; washing, bleaching, carbonizing; artificial wool; principal markets for raw materials; prices.

Manufacture: Spinning of the raw material; spinning processes; characteristics of yarns and their numbering; strength of yarns; making a sample book of yarns; weaving; distinction between woven and other, such as knitted, goods; principal parts of hand and power looms; purpose of the Jacquard and similar looms; dyeing of raw materials, of skeins, and of woven pieces; the important dyestuffs; testing colors; dyeing and printing processes; finishing, its processes and machines.

Finished products: Preparing a sample book of finished products, including all kinds of woven goods; description of materials according to their colors; density of the warp and weft; study of the various classes of woven fabrics; defects, tests, and calculations; location of establishments for the manufacture of various classes of goods.

Pattern designing: This study is used in connection with the description of materials, and is given with the view of enabling the students to recognize the various classes of woven goods and to estimate the materials consumed in their manufacture and the prices of the same.

Practical exercises in weaving: These are given with the purpose of making the students familiar with the processes of weaving, and of enabling them to recognize imperfections in weaving.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH COURSE FOR DYERS IN SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Subjects.	Hours per week.	
	First year.	Second year.
Chemistry and physics	2	2
Chemistry of fibers	2	2
Dyeing and chemical work in the laboratory	2	2
Total	6	6

These hours are given on Thursday evenings and Sunday mornings. The courses for weavers, designers, knitters, lace workers, and embroiderers include practical exercises at the handloom; analysis and production of knit goods; theoretical and practical instruction on knitting machines, power looms, hand and power lace-making machines, and

embroidery machines. The classes are held on Monday and Thursday evenings and Sunday mornings.

NUMBER OF STUDENTS IN ATTENDANCE AT SCHOOL FOR THE TEXTILE TRADES, BERLIN, 1900–01.

Course.	Summer term, 1900.	Winter term, 1900–01.
Day division:		
Weaving	8	12
Designing	25	23
Knitting		1
Passementerie making		3
Embroidery	10	13
Dyeing	2	3
Total	45	55
Evening and Sunday division:		
Mercantile	26	52
Dyeing	17	20
Weaving, designing, etc	105	95
Total	148	167

There were, in addition, in the day division, 1 special student in the designing section, 1 in the dyeing section, and 3 in the weaving section.

The latest year for which reports of the expenses of the school are available is 1897–98. In this year the total cost of running the school, with the exception of the expenses for heating, lighting, and repairs to building, was 70,533 marks ($16,787). The income, including 8,053 marks ($1,917) for tuition fees, was 13,730 marks ($3,268), leaving a deficit of 56,803 marks ($13,519), which was paid by the city and the State. The Chamber of Commerce and the Textile Association each contributed 4,000 marks ($952), while the Loom Workers' Association contributed 380 marks ($90.44) toward the city's share of the expense.

YEARLY TUITION FEES IN THE DAY DIVISION OF SCHOOL FOR THE TEXTILE TRADES, BERLIN.

Courses.	For Prussians.	For other Germans.	For foreigners.
Weaving, knitting, passementerie making, dyeing	$47.60	$71.40	$190.40
Designing	14.28	14.28	190.40
Special students (yearly tuition for each hour per week)	7.14	11.90	23.80

In the evening and Sunday division the fee is 30 marks ($7.14) per term for each course of 6 hours per week for those taking class work in weaving, the mercantile course, and dyeing. For designers, embroiderers, and others who take class work the fee is 6 marks ($1.43) per term for each weekly hour. For journeymen and apprentices in weaving, knitting, and passementerie making who are residents of Berlin or who work in the city, tuition is free. In the case of needy students of good character the fees are either wholly or partly remitted.

SCHOOL FOR THE TEXTILE TRADES, CREFELD, PRUSSIA.

The Crefeld weaving school, with its school for dyeing and finishing, is one of the most important in Germany or on the continent of Europe. The weaving school was erected in 1883, at a cost of $225,000. Since then it has been almost doubled in size by the erection of a new building for the dyeing and finishing departments, at an expense of $75,000. The rooms in the original building were thus set free to be used for the spinning and knitting operations. The school as now organized gives instruction in all the operations embraced in the textile industry, though, according to the general policy of each school specializing in respect to a particular branch of the industry, attention is chiefly given to the making of silk, satin, and velvet goods.

As regards the general equipment of this school, no better description can be given than that by the English Technical Instruction commissioners who visited this school in 1896.[a] After mentioning the fact that they had inspected the several designing rooms, class rooms, and studios and lecture theaters, rooms for the analysis of patterns and the collections of raw materials, and that they found nothing wanting to make the equipment of the school thoroughly up to date, they said:

> In the spacious quadrangle the large top-lighted weaving shed contains 88 different kinds of power looms, several of which are run by separate electric motors, besides 44 handlooms. We were informed that in no factory in the world, and certainly in no other school, are found so many varieties of looms for woven fabrics.
>
> The new dyeing and finishing school consists of a lofty three-story building, containing a series of top-lighted sheds for the machinery and workrooms. The laboratories for the analysis of colors and for private research are very extensive, and the dyeing school contains every essential that is found in the most complete dyehouses. The finishing department is equally well equipped, no expense having been spared either in the provision of the largest machines or of the smallest details. We were told that no commercial establishments were better equipped than this school, and that consequently every student passing through it had the advantage of starting on his business career with a full knowledge of the newest facts and methods.

The school at Crefeld, with its department for the application of art and science to the designing and dyeing of silk fabrics, must be regarded as affording another instance of the belief of German manufacturers in the value of the best artistic and technical instruction. They recognize that it is the design and finish that sell the fabrics, and they have therefore spared no expense in the equipment of their schools and in the provision of the best instruction.

By the president of the chamber of commerce and by other leading citizens the school was represented as the center of inspiration for the manufacturers of the whole district. The designers who have passed through it are kept in touch with all that it can teach by attending the

[a] Report on the Recent Progress of Technical Education in Germany, 1896.

conferences and lectures. If they wish for the adaptation of old forms and ideas in making their patterns they can go back to the best designs of every period. In the dyeing and finishing departments all new processes and colors are tested and analyzed, so that nothing is left to chance. * * * It was pointed out, moreover, that, owing to the many directions in which the school had fostered practical teaching, it had become possible, when the silk trade was depressed, to initiate new textile industries in Crefeld which might serve to occupy her machinery and find employment for her artisans.

One of the most important features of the school's equipment is the magnificent textile museum which it possesses. It contains over 8,000 numbers, and is said to be the finest collection of textile patterns in the world. Here are found fabrics which are of extreme historical as well as of technical value. The collection includes articles from the tombs of the Egyptians down to the fashionable designs of the present day, those of the fifteenth, sixteenth, and seventeenth centuries being especially well represented. There is also an oriental section with many fine examples of textile art. The collection is kept up to date, and receives constant additions by means of purchases from the proceeds of a fund devoted to that purpose. Some of the specimens have cost as much as $50 per square foot. Designers are in constant attendance copying the patterns. As a result of the display of Persian and Turkish carpet patterns an industry for the making of Smyrna worsted rugs has been started which gives employment to several hundred employees. As showing the importance attached to this feature, it may be remarked that the decorations alone of the museum galleries cost $30,000.

The school is also in possession of an excellent technical library, which contains an exceptionally complete collection of trade publications and technical literature.

The institution is strictly for advanced instruction, and is intended for the preparation of chemical specialists, dyers, bleachers, makers of print goods, finishers, etc. The courses are given only during the day. The only course for foremen is one on Sunday, treating of the analysis of samples. Students to be admitted must be at least 16 years of age, and it is desired that they should have had some practical experience in the trade. Very few of the students come directly from institutions of secondary instruction, the great majority of them having had some shop experience. A certain number come from the universities or polytechnical institutes, for the purpose of acquiring the more special training to be obtained in this school.

The school year consists of 42 weeks of 48 hours each. There are 7 regular courses, of which 2 are for wool and 5 for silk and other textiles. Great attention is paid to practical work in the shops and laboratories, the products of which are sold. The employers of the neighborhood often have recourse to this school for information, tests,

etc. Sometimes work of an elaborate character is undertaken for them by the school. The students make excursions of observation to industrial establishments.

The attendance in 1895-96 was 149, of which 117 were regular students, 18 special students, and 14 student designers. The Sunday course in the analysis of samples was followed by 116 students. The tuition fees are 300 marks ($71.40) for Prussians, 452 marks ($108) for other Germans, and 1,200 marks ($286) for foreigners. A considerable number of students, however, hold scholarships or receive aid in one way or another.

The employers in Crefeld and the surrounding district are favorably disposed toward the school. Not a few of the machines in possession of the school have been presented to it by them. They also contributed liberally to the expense of its erection, and have continued to aid it in many ways.

SCHOOL FOR THE TEXTILE TRADES, REUTLINGEN, WURTTEMBERG.

This school was founded in 1855 by the city of Reutlingen, with the assistance of an association of citizens interested in the movement. The scope of the school was gradually increased from the weaving school with which it started until in 1898 it comprised courses for hand and power loom weaving, knitting, spinning, designing, and dyeing. The courses offered are to prepare young men as manufacturers, factory directors, designers, and master spinners, weavers, and knitters. Commercial courses for dealers in textiles are also offered.

The courses of instruction comprise the following subjects:

Spinning course: Raw materials—cotton, sheep's wool, hemp, flax, jute, and silk. Spinning processes—their object; drawing and doubling; specifying the yarn numbers. Ginning—the various gins and their characteristics; mixing. Opening—description of the openers of Creighton, Platt, Lord, Raylor-Land. Carding—theory and description of the various roller and other cards, their advantages and practical uses. Combing—the various systems of combing of Heilmann, Hubner, the Alsace Machine Company, etc. Drawing—general principles; relative speeds of the cylinders, etc. Roving, spinning, self-actors, throstles, water frames; steaming, reeling, and packing; twisting; worsted yarns; general construction and arrangement of spinning mills; preparing plans and estimates of cost; numbers of workmen and wage cost.

Weaving course: The first half of this course is mainly theoretical, while the second half is principally practical work at the machines. The work requires one year. The subjects taken up are: Principles of weaving—recognizing weaving materials, wool, cotton, linen, silk, muslins, jute, etc. Study of the arrangements and accessories for preparing yarns for weaving; lectures on the formation of fabrics; design perforating. Investigation of fabrics made of various materials. Reckoning the quantities of yarn consumed and other factory costs in weaving. Decomposing and stenciling tissues with figures, etc. Jacquard weaving—analyzing various stuffs woven on Jacquard looms. Introduction to designing new forms of weaving, and samples of fabrics from suggestions of the instructor and from original ideas. Hand

weaving—practical weaving on the hand loom. Power-loom weaving—working on the preparatory machines, spooling, twisting, warping, sizing, etc.; weaving on looms of various kinds; weaving various kinds of fabrics; setting up power looms and accessory machines; tending and otherwise managing steam boilers, engines, and dynamos.

The theoretical instruction includes explanations of motors of various types, design perforating, warping, sizing; construction and running of looms and other machinery, sketching and drawing looms, etc.

Knitting course: This course is similar to those given above, in that it prepares pupils for the positions of factory managers, foremen, and master knitters. The following subjects are taught: Technology—study of knit fabrics, crocheted, netted, hand and machine knit goods; explanation of mesh and chain fabrics and their production; explanation of the machines on which they are made; examination and analysis of fabrics; calculating the quantity and ascertaining the value of material to be used on the knitting machines. Practical work—preparing materials and apparatus; practical work on the knitting machines; production of knit goods.

The second half year is devoted to explanations of the mesh machines, French and English circular machines, and the accessory apparatus. The other varieties of knitting machines are then taken up, and after the explanations actual work on each machine is done by the student.

Pattern designing course: This course covers two years, and is intended as a thorough preparation for those desiring to fill positions as pattern designers. The possession of some facility in drawing is required of candidates for admission. The work consists of drawing and painting of ornaments from plaster models and from nature, especially of plants; projections, shading, and perspective; theory of style and training in original designing; transferring designs on the perforated cards, and finally executing them on the loom.

Dyeing course: The work of this course includes general chemistry, the elements, and their combinations; the important raw materials used in dyeing; dyestuffs and mordants; sizing and finishing materials; technology of fibers, their action under the influence of chemicals; microscopic work; testing raw and other materials used in dyeing. Practical work in the laboratory with reference to the more important colors and the most improved methods of dyeing wool, silk, and cotton yarns and fabrics. Calculation of the cost of dyeing.

In the weaving course, after the pupil has had a sufficient general training he is allowed to specialize in the weaving of those fabrics to which he intends to devote himself on leaving the school. The school possesses 40 hand and 20 power looms, with the proper accessory machines, so that ample opportunity is given the student for practical work.

All candidates for admission to the school must be at least 16 years of age and have a good education. The courses are for one year, except in the school of pattern designing, where two years are required. The tuition fees for Germans are as follows:

Spinning course, 300 marks ($71.40); weaving course, 250 marks ($59.50); knitting course, 210 marks ($49.98); designing (per year), 60 marks ($14.28); dyeing (per year), 60 marks ($14.28).

The fees for foreigners are 50 per cent higher, except for the pattern designing course, where it is double that for Germans.

The regular teaching staff in 1902 consisted of a director, 7 teachers, and 3 shop foremen. There were 109 pupils in attendance. The State subsidy in 1902 amounted to 33,800 marks ($8,044).

TRADE AND INDUSTRIAL CONTINUATION SCHOOLS.

As previously stated there are two classes of schools in Germany which may be considered under the head of trade and industrial continuation schools, namely, industrial continuation schools and trade continuation and trade schools.

As the instruction given in the industrial continuation schools is more or less of a general character, the programmes of subjects taught are usually about the same, and in most cases they are prescribed, or their limitations are defined, by the State governments. For this reason, and because these schools, though very numerous, are mostly small, a detailed description of any individual industrial continuation school is unnecessary. As already mentioned, the instruction usually consists of German, including business forms, correspondence, etc., arithmetic, bookkeeping, free-hand drawing, and such technical or trade drawing as will best prepare the pupils for their particular vocations. In some cases other branches, such as foreign languages, geometry, physics, chemistry, etc., are also taught. The industrial continuation schools for girls usually teach German, arithmetic, drawing, and such manual work as is peculiar to the sex, namely, sewing, embroidery, cooking, mending, etc. In the larger cities of Germany, and wherever the attendance will justify, the work of the industrial continuation schools is so specialized for individual trades that they become trade continuation schools for single trades or for groups of trades, and are therefore considered under that head in the description of individual schools. Such, for instance, are the guild schools, the two artisans' schools, and the Industrial Hall of Berlin, which are described in detail.

In describing the individual schools, therefore, only the trade continuation and trade schools need be considered. The trade schools proper and the trade continuation schools are separately arranged for description.

Trade Schools for Single Trades.

The schools considered in detail under this head are only such as relate to single trades, and in which all-day instruction is given in both theoretical and practical work. While there are many of these schools in the German Empire, they are mostly small institutions which need not be described in this report. A selection has been made of a few of the most important types of trade schools, arranged alphabetically according to the trades.

SCHOOLS OF BASKET MAKING, WICKERWORKING, AND STRAW PLAITING, HEINSBERG, PRUSSIA.

A peculiar interest attaches to the schools which have been founded in different parts of Germany for giving instruction in basket making,

wickerworking, straw plaiting, etc., as here successful efforts have been made to create new industries or support declining ones for classes of the population greatly in need of remunerative work suitable to their abilities.

With the constant development of the factory system large classes of the population dwelling in the villages and rural districts have seen this means of subsistence gradually taken away. It is a serious problem in Germany, where the system of household production has grown to large proportions, to make some provision by which this class can be kept on a self-supporting basis. For a solution of this difficulty recourse has been had to the industry of wickerworking generally and basket making particularly.

In Germany, as indeed in Europe generally, an enormous use is made of baskets for the transportation of certain products. Almost all the vegetables and fruits of the farm, which in America are packed in boxes, barrels, and other receptacles made of wood, are in Germany transported in wicker baskets. Reeds and wicker are much used in the manufacture of furniture and other articles. The wicker industry is therefore one of great importance. From the standpoint of the decay of domestic work, the significance of this industry lies in the fact that the work can be done in small shops, or even in households. The Government has therefore sought to provide a means for gaining a livelihood to the people in need of work in the rural communities through the development of this industry, and in the accomplishment of this purpose main reliance has been placed on special schools giving the necessary instruction.

The best, as well as the oldest, of the basket-making schools is that at Heinsberg, a village not far from Aix-la-Chapelle. It not only has done excellent work in its own locality, but has trained most of the instructors in the other schools which have been erected on its model. This school was founded in 1876 by a group of public-spirited men who constituted themselves into a company for the purpose "of introducing and extending fine basket working in the Heinsberg region and giving to industrious families the opportunity to earn remunerative wages without leaving their homes." Owing to the decline in the hand-weaving industry the need for such instruction was then particularly urgent.

The school is in character an apprenticeship shop, as a great part of the students' time is given over to practical work. All the operations of basket and wicker work, including the making of cane furniture, the making and repairing of baskets, trunks, carriage bodies, etc., are taught. The theoretical studies include drawing, the elements of geometry, and writing. The student remains at the school two years if the full course is taken, the hours being from 8 a. m. to noon and from 2 to 7 p. m. Especial attention is paid to the finer branches of the trade. Lessons are also given in the cultivation of osiers.

The school has from 30 to 40 students in attendance. Their ages vary from 16 to 20 years. A contract of apprenticeship is made with each student. This contract provides for a penalty in case the student remains less than the full term of his service. A small remuneration is paid the students for the work done by them. This work is exposed for sale as in an ordinary commercial house.

The school is now supported partly by private benefaction and partly by subsidies from the State, province, and commune. A building has been erected especially for its accommodation. The school has had a great influence in developing the trade of wickerworking in its locality.

The success of the Heinsberg school speedily led to the establishment of similar schools in other parts of the country. Among the older of such schools are those located at Gehland, Schurgast, Thann, Gräwenwiesbach, Ruppertshofen, Orsoy, Daun, and Bettingen.

Similar efforts for the establishment of wickerworking schools have been made in Saxony, and there are now five schools located at Pirna, Wehlen, Schandau, Hohenstein, and Hinterhermsdorf. In addition to these Saxony has four schools for straw plaiting which are maintained by the communes. They are the school at Dippoldiswalde, founded in 1836; that at Güssing, founded in 1878; that at Altenberg, founded in 1878, and that at Bärenstein, founded in 1886.

SCHOOL OF ARTISTIC CARPENTRY AND CABINETMAKING, FLENSBURG, PRUSSIA.

The Flensburg school is an interesting example of a school maintaining close relations with practical shops. It was founded by a carpenter and joiner who was much impressed with the advantages of trade schools. After a number of years of existence it secured the recognition of the Government, and now receives a subsidy of 20,000 marks ($4,760) annually. It is in consequence subject to the supervision of the Prussian ministry of commerce. The distinctive characteristic of the school is the effort made to give instruction in the artistic branches of woodworking and to employ the students in the making of articles intended for sale. The school thus belongs to the class of industrial schools operating according to the apprenticeship workshop method.

The purpose of this school is thus to produce something more than skilled carpenters and joiners. It rather seeks to train a class of artistic woodworkers. Candidates for admission are subjected to more rigid requirements than is usual in guild schools. They must be at least 16 years of age, and pass a severe examination in drawing and other subjects.

The school is attended by three classes of students: (1) Wood carvers. These are received after having entered into a formal apprenticeship

contract for a term of four years. They receive a remuneration for work performed by them as agreed upon in the contract. (2) Carpenters. Students in this section must have had five or six years' actual practice in the trade. They work in the school shops as ordinary workmen, receiving the usual wages of the district. Evenings and Sunday mornings they devote to theoretical studies. For these privileges they pay a fee of 80 marks ($19.04) a year. (3) Joiners and artistic woodworkers. In this group the students devote their entire time, or 54 hours a week, to the study of their trade. The dues required of them are 150 marks ($35.70).

All the work of the students is performed in the private workshops of the director of the school.

The city of Flensburg possesses a museum of industrial art which is of great service to the school. The students can there find samples of all the leading types of furniture and familiarize themselves with the character of each.

Great attention is paid to drawing, both free-hand and mechanical, and to the theory and practice of designing and ornamentation. The method pursued is for the director to assign a given task to the pupils, such, for example, as the execution of a specified piece of furniture of certain materials that must cost not more than a given sum. The students are then required to make rough and detailed working drawings and devise the form and ornamentation. A comparison of the different plans is then made, and a selection of the best taken for execution. At each step the faults and the errors of judgment or taste are carefully pointed out to the pupil.

Mr. Omer Buyse in his report to the Belgian Government [a] concludes his account of this school with the following remarks:

> The experiment tried at Flensburg has been crowned with success. This school furnishes the proof that employers are more fitted than anyone else to create and direct trade schools. * * * The school at Flensburg finds itself in the most favorable condition to form perfect workmen. Practical work constitutes the field of experience where all the knowledge required finds its application and where the workman acquires the moral qualities resulting from personal effort. Under the direction of competent professors who have both practical knowledge and artistic taste he becomes initiated into the secrets of the trade, a result more quickly arrived at as he cooperates in the production of useful articles. Before taking up a specialty he acquires a general knowledge of all the branches of his trade. His artistic training keeps pace with his technical knowlege. In the treasures of the museum he learns the wholesome traditions of his trade; he familiarizes himself with the processes made use of by his predecessors and which cheap production has forced them to abandon. He acquires taste, ingenuity, the sense of proportion, logic, and sincerity.

[a] Étude sur les Écoles Techniques, etc., en Allemagne, par Omer Buyse, 1898.

SCHOOL OF CARPENTRY AND CABINETMAKING, MAGDEBURG, PRUSSIA.

The Magdeburg trade school for carpenters and cabinetmakers is a good example of the character of apprentice schools that have been organized in various trades by the guilds of Germany. This school was established by the carpenters' guild of the city as the result of the exertions of a successful master cabinetmaker. All the members of the guild agreed to give over to the school the time of each apprentice for one morning of a workday in each week and also to take turns in assisting in the work of instruction. All of the apprentices of course are not sent to the school on the same day, an apportionment being made so that the number attending each day will be about the same throughout the week. Thus each day from 30 to 40 apprentices are in attendance, while the total number receiving instruction is in the neighborhood of 200.

In order that the practical instruction of the apprentices may not be interfered with by their attendance upon the school, the apprentices agree to prolong their apprenticeship by three months, but this is not insisted upon where sufficient capability is shown.

The teaching staff is composed of a director, 4 teachers of carpentry, and 1 of wood turning. These teachers are trained by the guild itself, there being special courses and exercises for those persons desiring to fill these positions, either in the Magdeburg or in similar schools. The experience of the school is that a great advantage is obtained by securing teachers in this way, because the teachers, being themselves actively engaged in the trade, not only have knowledge of the character of the instruction needed, but are able to impart this knowledge in a way that can be readily comprehended by the apprentices. The following description of the school by Mr. Diederich, United States consul at Bremen, lays special emphasis on what can be done by a school without an elaborate equipment. (a) He says:

> I recently discovered at Magdeburg a school that aroused my interest to an unusual degree. Though somewhat familiar with educational work done in this country, and also with its technical schools, I had never yet seen such an institution. It seemed admirable—so much so that I deem it my duty to call attention to it, as it may interest others. There is no imposing architecture of any kind; no lecture halls, no chapel, no museum, no gymnasium, no campus; there are only half a dozen rooms on the top floor of a four-story building in a narrow side street. It has no faculty of brilliant scholars, but only a few devoted men. There is no liberal endowment by millionaire philanthropists, but a scant support from the Government, hardly sufficient, I was told, to keep body and soul of the institution together.
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> The school was founded by a Mr. Kiefhaber, a citizen of Magdeburg - a plain mechanic, a cabinetmaker, but a genius at his trade. After

a United States Consular Report, No. 238, July, 1900.

having been prosperous in business, he wished to aid young men apprenticed to the trade of furniture making and carving in his native town.

Under Prussian laws youths who, after having passed through the public schools, intend to learn a trade, are required to continue attending some school for some nights during the week and for two hours on Sunday. Such schools are called *Fortbildungsschulen*, a significant but untranslatable term signifying a school where the education is to be continued. Mr. Kiefhaber had, through his own long experience, become convinced that such schools could not accomplish this purpose satisfactorily, because boys at the age of from 14 to 17, after having been hard at work all day long, can not be in a condition, either physically or mentally, to attend school for hours with any benefit to themselves. He therefore conceived the idea of establishing the school above referred to. To accomplish his object, however, he needed the assistance of the Magdeburg union in the line of cabinetmaking, sculpturing, and carving. Their cooperation was granted him to the fullest extent. All the boss mechanics of the cabinetmakers, though most of them are men without any means, and therefore can ill afford to lose even time, agreed to send each of their appentices to this school for a whole forenoon in every week, and also to take turns in assisting in the work of teaching. As these lessons are given every day from 8 to 12 o'clock, each apprentice in Magdeburg gets four lessons a week, all bearing directly upon his future work.

I believe it is impossible to conceive of anything more practical than the teaching in these classes. * * * No question is put, no fact explained, no definition given, and no drawing made but has some bearing upon either the materials or the tools or the purposes of the combined trades mentioned above. No step forward is taken until the why and wherefore of the preceding step has been fully understood by everyone in the class. And, as in all schools of like character, great stress is laid upon free-hand drawing. This is to give the young men not only all the technical knowledge needed, but also to train the eye and the mind in designing every part of the various styles of furniture, as well as artistic decorations in wood carving and inlaid woodwork. * * *

There are only a few salaried teachers employed, while there are always several boss mechanics present, as already stated, assisting in various ways.

The following outline of the course of study has been obtained from the report of Mr. Omer Buyse to the Belgian Government:[a]

First year: The studies are based on principles of rational construction. Each article of furniture has a definite rôle to fill, and the dimensions, the form, and the construction must be adapted to this end. In order to give a proper understanding of the connection between the function and the form of an object, the instructor takes up for examination and discussion the ordinary articles of furniture with which the pupils are familiar, such as a chair, table, closet, bed, picture frame, door, stairway, etc. Thus, in connection with the chair, the pupils study the legs, the seat, the back, etc., and, in a general way, the conditions of its construction, solidity, the nature of the wood, the joints, placing of the legs, comfort resulting from the dimensions of the seat, the placing and the form of the back, the artistic appearance, the unity and

[a] Étude sur les Écoles Techniques, etc., en Allemagne, par Omer Buyse, 1898.

variety in its shape, etc. Lessons in drawing accompany these studies. The instructor sketches the article under consideration on the blackboard, with front and side views. It is said that this part of the instruction always arouses a lively interest on the part of the pupils, because it gives them the reasons for the work which they are doing in the shop every day.

Second year: After the introductory work of the first year the pupils take up the details of construction. The study of joints is made a special feature of this year's work; joints used in carpentry and cabinetmaking; their function, strength, and construction are carefully gone over; they are also drawn in projection and in perspective. Then the elements of furniture are taken up; the supports, the crosspieces, the panels, the bottom, the moldings, etc.; these parts are then combined to form the framework. This concludes the purely constructive work. The pupil has been shown the forms of pieces of furniture and how these forms are adapted to the uses for which the pieces are intended; he has thus been grounded in the elements of function, form, and dimensions of details—the first requisite of a good mechanic.

Third year: The actual needs of the woodworking industries, especially that of cabinetmaking, require more of a workman than a purely technical education. However simple a piece of furniture may be, it must still conform to certain æsthetic requirements. Severe rules impose on the workman the necessity of using forms in moldings, for instance, which must show that he is master of his opportunities. Since the decoration of furniture must be rigorously dominated by its function and the material of which it is built nothing advances the education of the workman more than a careful study of forms applied to the objects of his trade. The study of moldings is one of the most important parts of this education. They give to furniture its style and show the personality of the maker. Under the two heads of function and form, the instructor examines the different types of moldings and decorations and points out the manner in which they should be made to be the outward expression of the function of the object under discussion.

Fourth year: The last year is devoted to a study of ornament applied to woodwork, together with perspective drawing of the articles studied. The course is devoted to the study of complete sets of furniture, their construction and decoration.

SCHOOL OF HORSESHOEING, DRESDEN, SAXONY.

The industrial law of Saxony requires that only persons possessing a certificate granted by the Government authorizing them to do so can practice the trade of horseshoeing in the Kingdom. This certificate is granted only after candidates have passed the examination set by the State. To prepare candidates for this examination there is a special course at the State veterinary school at Dresden. Following is the description of this course as given in United States Consular Report 174, March, 1895:

The period of study required in the department of farriery is five months. After the student has been through the course of anatomy, and has attained a perfect knowledge of the action of the muscles of the horse, and understands the wonderful harmony of the animal's construction, his mind is ready for the intricate art of shoeing. In five months he will have grasped all the knowledge that is required respecting the manner of making and fitting shoes.

The student, while in the shops, has the advantage of seeing numbers of horses and all kinds of hoofs on which he must operate, always under the eye and directing influence of trained instructors. Not only has he these, but, in the museum, he has a collection of papier-maché hoofs, plaster casts, diagrams, etc., representing every possible

condition of hoof disease known; he has, also, for his guidance, a collection of shoes gathered from all parts of the world, from the first to the last invention.

The uses of the muscles in connection with the hoof are clearly demonstrated by illustrations and drawings. All this the student has learned in his study of anatomy; the more direct instructions as to how a horse should be shod are given in part second of the instructions on shoeing.

COURSES OF INSTRUCTION.

Part 1: To judge how a horse should be shod; how to hold a horse while shoeing; how to take off the old shoe; how to prepare the hoof for shoeing; preparing the hoof to go barefooted; making shoes of all kinds; measuring and judging thickness and weight of shoe for certain horses' hoofs; driving nails.

Shoeing horses that interfere and scrape their toes.

Shoes for winter; sharpening by means of ice nails; sharpening by means of steel tips; inserting calks with screws; arrangement of various kinds of calks.

Care of the shod hoof; care of the unshod hoof; smearing, bandaging, etc.

Part 2: General instructions regarding the shoeing of deformed hoofs, lameness, and division of hoof diseases.

Hoof covering—Inflammation to which it is subject; bad nailing; stepping on nails; stepping on coronet; stern galls and stone bruises; injuries from dirt and snow balling under shoe; foundered hoofs; rotten hoof and horn, or hoof swelling.

Change of hoof form—Flat and full hoof; buck and goat hoof; round hoofs; slanting or crooked hoofs; too sloping hoofs; ossified hoofs; split or cracked hoofs and treatment; horn break; loose hoofs; hollow hoofs; thrush, etc.

The above are some of the subjects that a student must know and know perfectly, in order to become a master farrier.

To enable persons to study farriery, and become masters in the art, under the laws governing the subject, the State has established in various parts of the Kingdom schools of farriery, the Dresden school being the central or parent for the local schools, sending them instructors, etc.

On May 1, 1900, 52 pupils attended the Dresden horseshoeing school. The school is in charge of an instructor, an assistant instructor of veterinary surgery, and two master horseshoers.

SCHOOL FOR MARINE MACHINISTS, FLENSBURG, PRUSSIA.

The purpose of the Flensburg school for marine machinists is the training of marine engineers and machinists for the commercial fleets of the country. Following is a condensed statement regarding this school, taken from the United States Consular Report No. 174, March, 1895:

There are four classes corresponding with the four classes enumerated under the imperial law of July 26, 1891, regulating the examinations and diplomas of machinists for sea or ocean steamers. The first and second class have annually two terms of twenty-two weeks each,

and the fourth class, two terms of eight weeks each. Besides these, the first and second classes have annually two preliminary courses of six weeks each. The expenses for first class are 50 marks ($11.90); second class, 40 marks ($9.52); third class, 30 marks ($7.14); fourth class, 20 marks ($4.76).

Plan of studies: Class IV—German, mathematics, and mechanics, 9, 3, and 22 hours per week, respectively. Class III—German and penmanship, 10; mathematics, 4; and mechanics, 22 hours per week. Class II—German, 4; English, 4; mathematics, 10; mechanics, 3; physics, 4; regulation of machines, 7; and drawing, 12 hours per week. Class I—German, 3; English, 5; planometry, 7; stereometry, 7; arithmetic, 7; trigonometry, 7; mechanics, 5; physics, 5; chemistry, 4; work on machines, 7; and drawing, 12 hours per week.

In the preliminary classes, they have English, 2; mathematics, 8; mechanics, 4; drawing, 8; and German, with special reference to technical terms, 10 hours per week.

Entrance: To enter the third and fourth classes, scholars must have passed through an elementary school. Directions are given in the school prospectus that boys who wish to begin with the second class should commence by attending *Fortbildungs* schools and taking up drawing, German, and arithmetic. The second class prepares boys who take examinations to enter the imperial marine. The preparatory course is for those who lack knowledge necessary to enter or keep up with the classes they enter, or want to enter. Inasmuch as the imperial examinations are exceedingly strict and impartial, the students desiring to take such are urged to come only after having passed through the very best possible preparatory course. How severe even the examinations for the various classes of machinists are, appears from the following extract from the law of July 26, 1891:

Class IV.—To enter this class, machinists must have passed either five years among the machinists of an ocean steamer, or part of five years among such and the remainder in a machine shop; two years, at least, must be on board ship.

Class III.—The young man must first have served two years as a fourth-class machinist, and two years either before or after obtaining a diploma as a fourth-class machinist.

Class II.—The applicant must have served, after his fifteenth year, five years in a machine shop or on board an ocean steamer. Two years must have been served on board ship, and two years in the shop, at the very least.

Class I.—Applicants must have served at least two years on board ship as machinists of the second class.

One may be examined for the second class without having entered the third or fourth classes, but to enter the third class one must have passed the examination and have served in the fourth class; to enter the first class, the candidate must have passed for and served in the second class. Only such time in a machine shop as has been employed in assisting in shipbuilding or repairing counts. Service as a fireman (feeding the boilers) counts only for the fourth class.

To obtain a fundamental, practical training, it is recommended to candidates to serve at least twelve months in a first-class machine shop, and, when possible, in a shipbuilder's machine shop; or with a locksmith and afterwards with a shipbuilding machinist. Apprentices are advised to put in their time of learning on small steamships, for the reason that they thus learn a great deal more and a great deal better. They are also urged to serve as stokers or firemen, to the end that they may be better able to judge later, when they advance, in regard to the fires and work thereon.

SCHOOL OF POTTERY, LANDSHUT, BAVARIA.

The object of this school is to train young persons in the pottery trade, and those who desire to enter that trade, to become skilled journeymen, foremen, and masters. To this end the pupils receive theoretical and practical instruction, the former being given in the continuation school and the latter in the pottery school proper. The practical instruction embraces a study of the clays used, of the materials used for glazing, the processes of mixing and working clay, and molding, drying, glazing, and burning earthenware, in which special attention is given to improvement in form. The instruction in modeling also develops the æsthetic taste in pupils. In accordance with a decree of August 15, 1896, pupils of the third year receive instruction in stove setting, enabling them to set up ordinary tile stoves. Only such apprentices are admitted to this school as have the necessary practical preparation for this work, and have had sufficient preliminary education to enable them to enter the continuation school. In exceptional cases, however, pupils may be admitted who have had no practical preparation in the pottery trade. Apprentices who have had experience receive wages according to their work and the usefulness of their products. Those who have had no practical training receive wages after they have advanced and shown their usefulness. Pupils of the latter class receive board and lodging at the school, upon application. Instruction is gratuitous, but a monthly charge of 4 marks (95 cents) is made for lodging, heat, and light. Needy pupils from lower Bavaria are provided with these accommodations free of charge.

The regular course of instruction in the pottery school proper covers three years. Deduction is made from this period in the case of pupils who have been apprenticed to a potter. They must, however, attend the school at least one year.

In accordance with a decree of the ministry of the interior for church and school affairs, yearly prizes are distributed to the pupils. A prize of 10 marks ($2.38) is given to each pupil who has done meritorious work in drawing and modeling, and whose conduct throughout the year has been good. Competitive prizes of 25 marks ($5.95) and 15 marks ($3.57), respectively, are awarded pupils who at the close of the year satisfactorily execute a given piece of work, from one to two days being allowed them for the same. The programme of instruction is as follows:

First division: Drawing—pupils who have had no instruction in drawing must take a systematic course in drawing, such as is given in the *Realschule*. It includes the drawing of straight and curved lines, plane geometrical figures, and leaf forms. Modeling: Making the simplest ornaments for leaf forms in clay, in various styles.

Second division: Drawing of antique vases, vessels, urns; exercises in simple color painting; drawing of ornamental and architectural forms in various styles for use in

stove decorations; fundamental principles of linear drawing; sketches and plans of stoves and fireplaces; modeling of animals' heads and feet, figures for stoves in the style of the Renaissance; ornaments in clay from antique models in Italian renaissance and Gothic forms, to be used on stoves.

SCHOOL OF TOY MAKING, SONNEBERG, SAXE-MEININGEN.

This school makes a specialty of the toy and doll making industry, for which this locality is famous. The school was founded in 1879 and has had a steady growth. There are three classes with 5 instructors. The subjects in which instruction is given are: German, arithmetic, geography, drawing, painting in water colors, modeling, preparing models and plans for toys, wood carving, wood turning, anatomy, drawing of projections, perspective, history of art.

A new building, for which the Government, assisted by private donations, bore the expense, was opened in 1901.

The United States Consular Report No. 249, June, 1901, gives the following description of the institution:

The massive stone building in which the school is located is 45 meters (147.6 feet) long and 15 meters (49.2 feet) deep and stands quite isolated, so that light and fresh air are freely admitted to the large rooms in which drawing and molding lessons are given; turning, wood carving, modeling of gypsum figures, and the preparation of the various kinds of clay for molding purposes are also taught. Space is provided for the exhibition of gypsum models, drawing patterns, etc. One room is principally used for modeling animals in life size, this being a specialty of the town of Sonneberg. Deserving of particular mention is the practical arrangement of the rooms in which the models and patterns are exhibited. They are separated from the large corridors only by glass and wood partitions instead of by heavy walls, so that not only plenty of light is admitted into the passages, but the visitor is shown at a glance the extent of the work in which the pupils are engaged. The building contains two rooms for the *Handelsfachschule* (a school in which commercial apprentices, in addition to the work they learn in the respective offices, are taught foreign languages, the theory of bookkeeping, commercial geography, etc.). The office of the Sonneberg chamber of commerce is also located here.

The exhibition of Sonneberg toys at the World's Fair in Chicago was the subject of general admiration, and at the Paris exposition it was awarded the grand prize. This remarkable success, it is generally admitted, is to a great extent due to the work of the industrial school, although this has had quarters entirely inadequate for the purpose.

The following table shows the number of pupils during the last ten years:

NUMBER OF PUPILS ATTENDING THE SCHOOL OF TOY MAKING, SONNEBERG, 1889-90 TO 1899-1900.

Year.	Pupils from—		Total.
	Sonneberg and its neighborhood.	Other parts of German Empire.	
1889-90	34	5	39
1890-91	34	8	42
1891-92	38	4	42
1892-93	39	4	43
1893-94	33	8	41
1894-95	32	9	41
1895-96	35	8	43
1896-97	47	10	57
1897-98	47	9	56
1898-99	43	8	51
1899-1900	46	8	54

Better accommodations being offered in the new home, the number of pupils is expected to increase considerably.

SCHOOL OF WATCH AND CLOCK MAKING, FURTWANGEN, BADEN.

This school was founded in 1877. It is a State institution, being under the immediate supervision of the State industrial school council. Its object is to advance the interests of the watch, clock, and instrument making industries of the Black Forest. It seeks to accomplish this object by training skilled journeymen, master workmen, and manufacturers in the various branches of these industries by means of a course of theoretical and practical instruction, and by offering advice and suggestions to persons engaged in the mechanical technical industries, especially on the subject of new constructions and patterns, testing of motors, working machines, etc.

The affairs of the school are managed by a board consisting of the mayor of Furtwangen and 7 associates. The teaching personnel comprises the director and 5 assistant instructors.

The school year opens May 1 and continues in session until about the middle of April, with an intermission from August 15 to September 15, and the usual Christmas and other holiday vacations.

Applicants for admission to the school must have attained the age of 14 years, and must have satisfied the common school requirements. Provision is also made for special students who desire to take either the practical or the theoretical course only, as far as the attendance of regular students, especially in the workshop, will admit, and provided that the general conditions for admission to the school are complied with, as in the case of regular students.

Tuition is 25 marks ($5.95) per year, payable in semiannual installments. Students of limited means may have their tuition fee remitted, either in whole or in part. Scholarships are provided for worthy, indus-

trious, and capable students who are residents of Baden. During the school year 1900–01 the amount of 3,013 marks ($717) was thus distributed of which 2,288 marks ($545) was appropriated by the State board of industrial education, and the balance by the districts of Billingen, Freiburg, and Baden. All requisites for study are furnished by the school with the exception of writing books, drawing instruments, and fragile tools.

The regular course covers three years. At the close of the school year public examinations and exhibitions are held, and prizes are awarded to pupils who have executed the best work. The work executed by the pupils belongs to the school, but it may be acquired by the pupils upon the payment of a price fixed by the school board. During the summer months the hours of instruction are from 7 a. m. to 12 m. and from 1.30 to 7 p. m.; during the winter months from 8 a. m. to 12 m. and from 1.30 to 7 p. m.

The school is divided into two departments—the department for watch and clock makers and the department for makers of instruments of precision and electrical apparatus.

The following programme shows the subjects pursued in each department and the number of hours per week devoted to each:

DEPARTMENT FOR WATCH AND CLOCK MAKERS.

First year: Arithmetic, 1 in summer; algebra, 2; geometry, stereometry, trigonometry, 2; experimental physics, 1; technology, 1; geometrical drawing, 4 in summer; projections, 4 in winter; free-hand drawing, 2; business forms and correspondence, 1; penmanship, 1; shopwork, 47 in summer, 43 in winter.

Second year: Algebra, stereometry 2; technology, 1; physics, 1; mechanics, 2; bookkeeping and exchange, 1; free-hand drawing, 2; theory of watch and clock construction, 3; exercises in the theory of watch and clock construction, 6; shopwork, 43 in summer, 17 in winter.

Third year: Theory of watch and clock construction, 2 in summer, 1 in winter; exercises in construction, 6; shopwork, 53 in summer, 49 in winter.

DEPARTMENT FOR MAKERS OF INSTRUMENTS OF PRECISION AND ELECTRICAL APPARATUS.

First year: Arithmetic, 1 in summer; algebra, 2; geometry, stereometry, trigonometry, 2; experimental physics, 1; technology, 1; geometrical drawing, 4 in summer; projections, 4 in winter; free-hand drawing, 2; business forms and correspondence, 1; penmanship, 1; shopwork, 46 in summer, 42 in winter.

Second year: Algebra, stereometry, 2; technology, 1; physics, 1; mechanics, 2; bookkeeping and exchange, 1; free-hand drawing, 2; electro-technics and magnetism, 2; exercises in construction, 6; shopwork, 43 in summer, 39 in winter.

Third year: Technology, 1; mechanics, 1; electro-technics, 2; exercises in construction, 6; shopwork, 53 in summer, 49 in winter.

Following is a synopsis of such of the foregoing subjects as are of special interest:

Technology with exercises in sketching: Production and properties of metals; alloys; smelting; losses in smelting; crucibles and furnaces; amount of shrinkage; casting in sand and in clay; furnace, box, and stencil molding; core making; casting metals; working of material according to their malleability; apparatus for heating

materials; striking, stamping, and pressing tools; working materials according to their divisibility; cutting, shaving, and rasping tools; lathes; planing machines, drilling machines; grinding machines, etc. Also the following for makers of instruments of precision and electrical apparatus: Welding; soldering, gluing, cementing; polishing; engraving, etching, staining, and coloring metals; electroplating of metals; precipitates of metals.

Mechanics: Composition and resolution of forces; parallelogram of forces; center of gravity; elementary machines; the various kinds of motion; acceleration; momentum of inertia; mechanical work; mechanical effect; friction; efficiency of machines, etc.

Electro-technics and magnetism: The electric state; sources of electricity; the stationary electric current; the relation of bodies with reference to the electric current; effects of heat; mechanical effects; physiological effects; electro-magnetic apparatus; application of electricity to house telegraphy; construction, application, and disposition of the telephone and microphone; lightning rods; electrical measuring instruments; methods of measurements; drawing of tools and the smaller apparatus used in fine mechanics and in electro-technics from copies and models.

Theory of watch and clock construction: Gearing; chain; chain wheel; strings and cords; barrels; ratchets; theory of the draw spring; spring boxes; cogwheels; cylindrical and conical wheels; the endless screw; screw wheels; laws of the pendulum; relation between mathematical and physical pendulums; center of oscillation; the simple pendulum; compensation pendulums; period of oscillation; escapements; study of cylinder, anchor, and other escapements; computation and construction of the dial and the striking mechanism; alarm mechanism; calculation of entire clock works; calculation of making alterations; electrical regulator clocks; electrical dial mechanism; clock with electric ratchet wheels; regulating regulator clocks; electric registering apparatus; electric water gauges; electric chronographs and chronoscopes; electric meters; exercises in drawing parts of watches and clocks from copies and models in connection with the theoretical studies; calculating, drawing, and construing difficult escapements of striking and repeating mechanism; calendar mechanism, and entire clock works from copies, models, and sketches.

Shopwork: For watchmakers the exercises comprise work in filing, turning, boring, making small tools and component parts of clocks and watches; finishing, mounting, adjusting, and regulating clocks and watches; watches for special purposes, chronographs and marine chronometers.

For makers of instruments of precision and electrical apparatus the exercises comprise work in filing, turning, boring, running working machines, making tools and small instruments of precision, electrical clocks, telephones, microphones, box compasses, measuring instruments for electrical purposes, small dynamos and electromotors.

The annual expenses of students, including tuition, board, etc., range between 400 marks ($95.20) and 540 marks ($128.52), according to the means of each student.

The total number of students in attendance during the school year 1900–1901 was 70. Of this number, 29 attended the first-year class, 21 the second-year class, 15 the third-year class, and 5 were special students.

SCHOOL OF WATCHMAKING, FINE MECHANICS, AND ELECTRO-TECHNICS, SCHWENNINGEN, WURTTEMBERG.

This school provides theoretical and practical instruction in the various branches of instrument making, including clock and watch

making and electro-technics. Its capacity is limited to 60 students. Preference is given to residents of Wurttemberg, but residents of other German States or of foreign countries may be admitted to the school if a sufficient number of residents of Wurttemberg fail to apply for admission.

The school opens on the first day of May each year and continues in session until the latter part of April, with an intermission from September 1 to September 30 and the usual holiday vacations. The hours of instruction during the summer season are from 7 a. m. to 12 m. and from 1.30 to 7 p. m.; during the winter season from 8 a. m. to 12 m. and from 1.30 to 7 p. m.

The school provides for a three years' course. To be admitted to the first-year grade applicants must have attained the age of 14 years and must have satisfied the common-school requirements.

Applicants who have served an apprenticeship and have attended a continuation school may be admitted direct to the second-year grade and exceptionally to the third-year grade, provided they furnish satisfactory evidence that they have pursued a preparatory course elsewhere and are qualified for the work of the grade to which they apply for admission. Adults, who already have a fixed occupation, may be admitted to the school as special students without examination. They may attend either the theoretical course only, or the theoretical course with its exercises in the workshop, for a period not exceeding one year.

Tuition for residents of Germany is 25 marks ($5.95) per year, and for foreign residents 100 marks ($23.80) per year. Special students who take the theoretical course with its exercises in the workshop pay the same tuition per year with a proportionate reduction for a shorter period, the minimum fees, however, being 12 marks 50 pfennigs ($2.98) and 50 marks ($11.90), respectively. Special students who take the theoretical course only pay a quarterly fee of 3 marks (71 cents) for each hour per week; residents of foreign countries are charged double this amount.

The following programme shows the subjects taught, with the number of hours per week devoted to each:

First year: Arithmetic, 2; geometry, stereometry, and plane trigonometry, 2; exercises in arithmetic, geometry, etc., 1; experimental physics, 2; technology, 1; geometrical drawing, summer term, 6; projections, winter term, 4; free-hand drawing, 3; business correspondence, 2; shopwork, summer term, 46; winter term, 42.

Second year—all students: Mechanics of solids, 2; technology, 2; bookkeeping and business computations, 2; free-hand drawing, 2; physics, 2. For watchmakers—construction of clocks and watches, 4; constructive exercises, summer term, 6; winter term, 4; mathematics, 2; shopwork, summer term, 43; winter term, 39. For instrument makers and electricians—constructive exercises, summer term, 8; winter term, 6; electric currents, 2; shopwork, summer term, 45; winter term, 41.

Third year: For watchmakers—clocks and watches for special purposes and construction of special machines, 2; constructive exercises, summer term, 6; winter

term, 4; mathematics, 2; shopwork, summer term, 53; winter term, 49. For instrument makers and electricians—constructive exercises, summer term, 8; winter term, 6; electric currents, 2; shopwork, summer term, 53; winter term, 49.

The instruction in the workshop begins with a series of exercises in filing, turning, boring, drilling, and the making of tools. Watchmakers have practice in making parts of clocks and watches; in constructing, taking apart, and adjusting clockwork or watches; in making clocks and watches for special purposes, chronographs, marine chronometers, etc., and in repairing. Instrument makers and electricians have practice in taking care of working machines; in making small instruments and apparatus relating to electro-technics; in making electrical clocks, telephones, microphones, compasses, etc.; in making instruments of precision relating to the specialty of the student, as measuring instruments for electro-technical purposes, electric lamps, electro-motors, etc.

The work made by the students in the workshop during the hours of instruction and for which the material has been furnished by the institution becomes the property of the school; but it may be acquired by the student upon the payment of a price fixed by the school board.

The teaching staff in 1902 consisted of a director, 1 assistant, and 3 shop foremen. On December 3, 1901, the students in attendance numbered 57.

In 1902 the State granted a subsidy of 26,000 marks ($6,188).

SCHOOL OF WOOD CARVING, FURTWANGEN, BADEN.

This school was founded in 1877. Its object is the furtherance of the wood carving and joinery industries of the Black Forest region by giving instruction in the various branches of wood carving and joinery, thereby developing skilled workmen, also aiding these industries in every possible manner.

The school year opens the beginning of May and closes the end of April, vacations being granted from August 15 to September 15 and from Christmas to New Year. In order to be admitted candidates must be 14 years of age, must be physically fitted, and must have completed their common school education. A special examination must be passed by nonresidents of Baden before they can be admitted. In special cases, pupils may be admitted who desire to take individual branches only.

The tuition fee is 20 marks ($4.76) per year. Pupils must furnish their own drawing instruments and the tools for wood carving, the school furnishing all other requisites. Needy pupils are supplied with tools, etc., and the tuition fee is also remitted. The articles made by the pupils are the property of the school.

The courses of instruction cover one year, and embrace five branches: Wood carving, modeling in clay and wax, free-hand and projection drawing, shaping from models, and joinery. During the summer 45¾ hours per week are devoted to the wood-carving branch, 7¼ hours to modeling and shaping from models, and 12½ hours to drawing. During the winter 40 hours per week are devoted to the wood-carving

branch, 9¼ hours to modeling and shaping from models, 14 hours to drawing, and 54 hours to the joinery branch.

The pupils are systematically taught in carving, modeling, and drawing. They are taught from the simplest leaf forms to the finest ornamental work.

The work in joinery is thorough and enables the pupils to execute entire pieces of furniture. The school endeavors to keep pace with the most modern styles. During the past year it has executed several pieces of carving and joinery work in colored wood. The school is kept supplied with new models, etc., as the nature of the work requires. It keeps in touch with the local industry by executing pieces of work for local establishments and by loaning models.

The board of administration of the school consists of the mayor and seven associates. The teaching personnel consists of a director, 5 instructors, and 3 assistants.

Thirty-five pupils attended the school during the school year 1900–01. Of these, 28 were carvers, 6 were joiners, and 1 was a special pupil. Sixteen pupils received prizes at the close of the school year, 1899-1900, and 6 received honorable mention. A sum of 380 marks ($90.44), realized from the sale of carved work executed by the pupils, was distributed to worthy and needy pupils. The sum of 1,628 marks ($387) was realized from the sale of articles executed by pupils during the year 1899–1900.

The director of the school generally procures positions for graduates in the various establishments of the Black Forest region. A public exhibition is held at the close of the school year for the purpose of displaying work executed by the pupils, and prizes are awarded to those who have been the most successful.

The school received subsidies and donations for scholarships amounting to 6,850 marks ($1,630) from the ministry of the interior, the industrial school board of the Duchy of Baden, and from other sources. The assets or receipts for 1900 amounted to 3,969 marks ($945) for stipends and prizes, and 4,250 marks ($1,012) for trade-school expenses.

Trade Continuation Schools.

These schools are intended to give to apprentices and journeymen, but particularly to the former, such theoretical instruction pertaining to their trades as they are not apt to obtain in a private workshop. They are largely conducted by trade guilds. As the city of Berlin, Prussia, possesses some of the best trade continuation schools in Germany, a selection from the schools of that city has been made for individual description. In 1901 there were in Berlin special trade continuation schools for bakers, barbers and hairdressers, basket makers, blacksmiths, bookbinders, cabinetmakers, chimney sweeps, confectioners, coopers, gardeners, glaziers, painters, paper hangers,

photographers, potters, printers, saddlers, shoemakers, tailors, tinsmiths, and wagon makers and wheelwrights. There were, in addition, four continuation schools where special trade instruction was given in several distinct trades for males, and a number of similar municipal and private schools for females.

The schools in which several trades are taught are first described, and these are followed by the schools for single trades in the alphabetical order of the occupations taught.

ARTISANS' SCHOOL NO. 1, BERLIN.

This is the first of the two institutions, known as *Handwerkerschulen*, founded by the city of Berlin and subsidized by the State. These institutions combine the features both of industrial and of special trade continuation schools, and also include day classes in theoretical and laboratory work. They are governed by the same board which has charge of the building-trades school, described elsewhere, and are very highly regarded in Berlin.

Artisans' school No. 1 was established in 1880. Its purpose is "to give to apprentices and workmen, especially during their leisure hours, a knowledge of drawing and the applied sciences and arts which concern their respective trades, and which serve as the necessary complement to their shop practice." The programme of instruction includes a large variety of courses of study the selection of which is optional with the pupils, except that for the advanced classes pupils must show that they possess the necessary preparatory knowledge. Following is a list of the courses and the hours per week devoted to each:

Free-hand drawing, 2 and 4; aquarelle, 4; drawing with compasses, 2 and 4; projection drawing, 4; descriptive geometry, 4; trade drawing, according to occupation, 4; study of forms of ornamentation, 4; modeling in clay and wax, 4; decorative painting, 4; arithmetic, 2; algebra, 2; geometry, 2; trigonometry, 2; higher mathematics, introducing analytical geometry, differential and integral calculus, 1; mathematical exercises, including problems in physics and mechanics, 2; physics, 4; mechanics, 2; electro-technics, 4; chemistry, 4; chemistry and pharmacy, 4; bookkeeping, 2.

The purpose of offering so many courses is to enable each student to select those which will be of greatest service to him in his work. Thus the instruction in trade drawing is specialized in separate courses for cabinetmakers, wood turners, tinsmiths, locksmiths, artistic wrought-iron workers, machine builders, electricians, watch and clock makers, masons, carpenters, stonecutters, coppersmiths, goldsmiths, silversmiths, brass workers, gas fitters and plumbers, locksmiths and structural iron workers, makers of scientific instruments, opticians, engravers, wood and stone carvers, pattern makers, painters, paper hangers, decorators, lithographers, and printers.

The hours of instruction for these courses are, as a rule, in the afternoon and evening of week days and on Sunday mornings.

In addition to these courses there are the following special trade schools and classes connected with this institution: A trade school for instrument makers, with a one-year day course; a day class in electro-technics, with a one-year course; a day class for cabinetmakers; a day class for painters; a day class in modeling; and a trade class for compositors.

TRADE SCHOOL FOR INSTRUMENT MAKERS.

This school, known as *Fachschule für Mechaniker*, is intended to give the needed theoretical knowledge to makers of instruments of precision and of electrical apparatus. It gives the journeymen in this trade the opportunity of obtaining such a knowledge of mathematics, physics, mechanics, instruments, electro-technics, technology, and industrial drawing as a foreman or superintendent of an establishment for instrument making ought to possess. At the same time it gives to the students a foundation for further study in the special direction of fine mechanics and electro-technics.

The course of study covers one year, beginning in October. Persons attending only one half year may obtain certificates of attendance for that period.

The hours per week devoted to each study are as follows:

First half year: Mathematics, 5; physics, 5; exercises in physical mathematics, 3; technical mechanics, 3; study of instruments, 4; electro-technics, 4; technology, 2; drawing, 14; total, 40 hours per week.

Second half year: Mathematics, 2; physics, 3; exercises in physical mathematics, 2; chemistry, 2; technical mechanics, 2; study of instruments, 4; electro-technics, 4; technology, 2; drawing and sketching, 14; practical exercises in the physical laboratory and excursions, 5; total, 40 hours per week.

DAY CLASS IN ELECTRO-TECHNICS.

This class is intended to give to journeymen electricians such theoretical instruction as will fit them to become mounters of electrical apparatus, and foremen, laboratory workers, etc., in factories and other establishments.

The course covers one year, beginning in October. A pupil who desires to leave after completing the first half year can obtain a certificate of attendance during that period.

The hours per week devoted to each study are as follows:

First half year: Mathematics, 4; physics, 5; chemistry, 2; electro-technics, 16; drawing, 8; laboratory work and excursions, 9; total, 44 hours.

Second half year: Mathematics, 3; physics, 2; chemistry, 2; electro-technics, 14; motor machinery, 2; drawing and sketching, 10; laboratory work and excursions, 9; total, 42 hours.

DAY CLASS FOR CABINETMAKERS.

This class is intended to give such instruction and skill in drawing as will enable journeymen, masters, draftsmen, or superintendents of cabinetmaking establishments to understand and to prepare working

plans and sketches used in their lines of work, namely, in furniture making, building joinery, and interior decorations. The class is divided into two grades.

The courses begin in April and October of each year, instruction being given during 40 hours of each week. Persons are not admitted to the higher grade unless they have completed the studies provided for in the lower grade. Each course covers one term.

The instruction given in the lower grade consists of drawing with compasses; projection drawing; descriptive geometry; shading; ornamental drawing and sketching simple ornaments; drawing of architectural decorative objects, accompanied by descriptive statements; preparing sketches and specifications of furniture; measuring and sketching parts of furniture and of whole pieces; preparing drawings for use in workshops; designing simple furniture; and building joinery work.

The instruction given in the higher grade consists of designing ornaments, shadow work, and perspective; study of styles of ornamentation for furniture and interior decoration; exercises in sketching and preparing specifications.

DAY CLASS FOR PAINTERS.

This class is organized for the purpose of giving journeymen and apprentices an opportunity to secure instruction in drawing, painting, and the various technical features of their trade during the four winter months.

Those who possess only a slight facility in drawing when they enter are first given work in drawing surface ornamentation and painting in water colors. This is followed by drawing from plastic ornaments in outline, executing drawings in white and black, and water-color painting.

Students who are familiar with such work begin with drawing and painting from plastic models and executing in colors. They are encouraged as far as possible to cultivate an independent taste in the use of colors. Advanced students who have had practical experience and have acquired some skill in drawing take up the preparation of working drawings, or decorations for ceilings, walls, etc., and execute studies in life size from sketches and models.

Students of more than average ability take work in aquarelle and execute larger decorative plans with figures. They also do painting from nature (still life, flowers), draperies, etc.

The courses begin in November and end with the close of February. Students may enter at any time.

DAY CLASS IN MODELING.

These classes are intended for wood carvers, modelers, engravers, chasers, etc. An effort is made to give the students such skill in

modeling in clay and wax as will enable them to perform the work of their occupations.

Modeling of ornaments is taken as the basis of the work, and is done from plastic samples, photographs, and drawings. Advanced students are given plans to execute for receptacles, furniture, etc. The study of nature forms and their application in ornamenting is given special attention.

The modeling of figures is done first from plaster casts and casts from natural objects. Advanced students have work in portraiture and modeling from life every afternoon.

The purpose of the instruction is to enable the student to execute the decorative and artistic designs used in practical life with a consistent use of figure and ornament decoration.

The courses are given in the morning and evening and require thirty-six hours per week. Students may enter at any time during the term, which begins on the 1st of October.

TRADE CLASS FOR COMPOSITORS.

This class offers opportunities to journeymen compositors and printers to educate themselves in the artistic and technical branches of their trade. The course of instruction, which begins in April and October of each year, covers two half-year terms. During the winter term 1900–01 it comprised the following subjects:

Section A: Sundays, 8 a. m. to 12 m.—Typographic sketching and designing. This includes instruction and practice in typographical arrangement; styles of type; typographical ornamentation and its application; study of colors; the technical application of colors; printing in colors. Mondays and Thursdays, 7 to 9 p. m.—Drawing letters, ornaments, and plants; designing; study of styles.

Section B: Tuesday and Friday, 7 to 9 p. m.—Typographical sketching and designing, continued. This includes instruction and practice in book work, job work, etc.

Section C: Sunday, 8 a. m. to 12 m.—Trade instruction consisting of lectures, demonstrations, and practice. From 8 to 10 a. m.—Study of machinery; the latest styles of presses; printing of illustrations; electric power transmission and lighting in printing establishments. From 10 a. m. to 12 m.—Engraving on metal and other materials and treatment of plates.

Regular attendance is required at this handicraft school. Certificates are given at the close of each half-year term. The tuition for the half-year term, payable in advance, is as follows: For the evening and Sunday courses: 6 marks ($1.43) for 8 hours per week or under; 9 marks ($2.14) for 9 to 12 hours per week; 12 marks ($2.86) for 13 hours per week or over; course in electrical installation, 6 marks ($1.43). For the trade and day classes: Trade school for instrument makers, 60 marks ($14.28); day class in electro-technics, 100 marks ($23.80); day classes for cabinetmakers and painters and in modeling, 5 marks ($1.19) per month; trade class for compositors, same as for

the evening and Sunday courses. Persons without means may be granted scholarships.

The total attendance at Artisans' School No. 1 was 1,988 in the summer of 1900 and 2,570 in the winter of 1900–01.

ARTISANS' SCHOOL NO. 2, BERLIN.

This school, which was patterned after Artisans' School No. 1, was opened in 1892. The evening and Sunday courses cover very nearly the same subjects as those in the other school.

Two courses not given in the other school are chasing, 4 hours per week, and practical exercises in artistic wrought-iron work, 4 hours per week. The former course includes chasing and relief work, that is, chasing of hollow objects and their decoration with ornaments and figure designs copied from drawings, models, nature, and photographs. The instruction is intended for chasers, gold and silver smiths, braziers, artistic wrought-iron workers, and copper and tin smiths. The practical exercises in artistic wrought-iron work consist of forging, chasing and engraving ornaments, mounting, and decorations for utensils, gratings, trellises, and house fixtures, from models, drawings, photographs, etc., the various styles of ornamentation being considered.

Another subject not taught in the other school is that of sketching and calculating the elements of machinery. The instruction consists of 2 one-year courses of 2 hours per week each.

In addition to the Sunday and evening courses, this school has a day class for painters and a day class for braziers and artistic metal workers. The day class for painters is similar to that of the other school.

DAY CLASS FOR BRAZIERS AND ARTISTIC METAL WORKERS.

This class is conducted for the purpose of training students in drawing and designing artistic objects in bronze and wrought iron, such as chandeliers, utensils, gratings for windows, doors, and similar objects of artistic value. The production of these articles constitutes one of the most prominent industries of Berlin, and the school aims to furnish a supply of skilled workmen for the establishments engaged in this branch. The training given is such as to fit the students to fill positions as foremen, managers, or designers.

The subjects taught are as follows: Free-hand drawing, designing of ornaments, and water-color work, including drawing of ornaments, figures, and utensils from plaster and other models, with special consideration of the treatment required by the various kinds of material used in the different branches of artistic work; designing of ornaments; water-color work. Architectural drawing comprises drawing of profiles, bases, moldings, capitals, pedestals, window and door casings, ceilings, the application of architectural forms to industrial art objects.

The braziers and those who are engaged in related trades study technical drawing and designing and are taught to make sketches of utensils which serve as samples for the work to be executed; advanced students practice in detail work from given sketches and models, and design objects of various kinds. From these designs the working drawings with the necessary details are made for the modelers and braziers. The artistic ironworkers make sketches of rosettes, foliates, and other ornamental forms, and then design wrought-iron utensils, trellises, chandeliers, and similar articles. Advanced students do detail work from given sketches and samples, and design articles from specifications given by the instructor. From these designs the working drawings with all necessary details are made. Every two weeks contests are held in original work to stimulate independence in designing.

The work of sketching is given with the view of enabling the student to copy designs from museums, exhibitions, etc.

The development of ornamental forms and their proper application to products of the industrial arts from classic times to the present, illustrated by drawings, discussions, and graphic presentations is embraced in the study of industrial art forms. In addition, visits are made to the various establishments producing industrial art objects.

The instruction is given in half-year courses. Following are the hours devoted to each branch:

Free hand drawing and designing, and water-color work, 8; architectural drawing, 4; trade drawing and designing objects of industrial art, 19; sketching, 4; descriptive geometry, 6; study of forms of industrial art, 4.

The regulations and tuition rates are the same as in Artisans' School No. 1 for similar branches. The tuition for the day class for braziers and artistic metal workers is 30 marks ($7.14) per half-year term.

The total attendance at Artisans' School No. 2 was 983 in the summer of 1900 and 1,608 in the winter of 1900–01.

THE INDUSTRIAL HALL, BERLIN.

In the continuation schools a great deal of attention is given to mechanical drawing. This special kind of drawing—the so-called drawing of working models—is stated to be the backbone of instruction offered in the continuation schools. As this system developed it became increasingly important that instruction should be of the proper character and particularly that it should have direct relation to industrial pursuits. This could best be accomplished by some system whereby the instruction or its supervision should be centralized. There was accordingly created in Berlin what is known as the central industrial hall (*Gewerbesaal*) where all branches of industry were united in one institution and taught by a special and well-qualified group of teachers. The head of the institution is the supervisor of technical

mechanical drawing courses. He selects proper teachers and determines the method and means of instruction, so that now the city authority has some guaranty that the various industrial courses are appropriately prepared for by the instruction given in drawing.

The Industrial Hall has 10 branch schools distributed over the various parts of the city, so that everyone may find means of instruction near at home. These courses are, with one exception, offered in the evenings and on Sundays.

In order to attend one of these schools the person must follow the trade to which the course selected relates, must have finished his primary education, and must pay a tuition fee of 4 marks (95 cents) each semester. The instruction includes special drawing classes for the different trades. Following is a list of the evening and Sunday courses, and the hours per week devoted to each:

Preparatory drawing, 4; trade drawing for machine builders, 4; trade drawing for instrument makers, 4; trade drawing for house and locksmiths, 4; trade drawing for artistic wrought-iron workers, 4; trade drawing for structural-iron workers, 4; modeling for artistic wrought-iron workers, 4; mathematics, mechanics, and machinery, 2. In addition, there are day classes for machine builders, with 36 hours' instruction per week.

The character of the instruction given in the evening and Sunday classes may be seen from the course prescribed for machine builders.

The course for machine builders includes drawing of parts of machines from models with the dimensions given; free-hand sketching from models and preparation of working drawings from these sketches; drawing from models with modifications from the originals; preparation of tracings from pencil drawings. For students sufficiently advanced the work consists of designing parts of machines, executing drawings in various styles, and designing entire machines.

The day classes for machine builders offer courses covering 36 hours per week for two half years. Fourteen of the 36 hours are devoted to drawing; the other hours are given to mathematics, physics, chemistry, mechanics, elements of machinery, materials, and electro-technics. To be admitted to this school students must have had three years' experience in their trade; they must have had a good common school education and possess some facility in drawing. The tuition fee is 50 marks ($11.90) per term.

The ten branch schools of the Industrial Hall have evening and Sunday trade drawing classes for instrument makers, electricians, machine builders, locksmiths, artistic wrought-iron workers, classes in modeling, preparatory trade drawing, projection drawing, mechanics, machinery, mathematics, and algebra. These classes are all held in the rooms of public schools.

The latest year for which reports on finances are available is 1898–99. During this year the total expense of conducting the school was

59,570 marks ($14,178). A total of 15,702 marks ($3,737) was received from tuition fees, leaving 43,868 marks ($10,441) to be supplied by the city.

The following table shows the attendance at the Industrial Hall for a series of years:

ATTENDANCE AT THE INDUSTRIAL HALL, BERLIN, 1893–94 TO 1900–01.

Year.	Number of students.		Year.	Number of students.	
	Summer term.	Winter term.		Summer term.	Winter term.
1893–94	1,151	1,333	1897–98	1,508	1,834
1894–95	1,235	1,367	1898–99	1,720	2,176
1895–96	1,151	1,471	1899–1900	1,922	2,303
1896–97	1,321	1,717	1900–01	1,978	2,385

In 1899–1900 the attendance at the day school for machine builders was 25 during the summer term and 34 during the winter term.

MUNICIPAL CONTINUATION SCHOOLS FOR GIRLS, BERLIN.

There were nine of these schools in Berlin in 1901, but as their courses of instruction, organization, and management are about the same they may be described collectively as a single school. The object of these schools is to supplement the common school education in such a way as to prepare girls for practical work of all kinds and to encourage a taste for such vocations as properly belong to the woman's sphere. They are maintained exclusively by the city.

The instruction is arranged in courses. These include German, arithmetic, drawing, bookkeeping, French, English, stenography, typewriting, sewing, embroidery and other handiwork, cutting for garments, machine sewing, machine embroidery, tailoring, ironing, millinery, cooking, singing, penmanship, and gymnastics. Each branch constitutes a course, the courses, with few exceptions, being divided into from two to eight graded classes.

The classes are usually in session two hours per week, although in a few cases they continue for three or four hours. The hours are generally from 3 to 5 p. m., 5 to 7 p. m., and 7 to 9 p. m. on week days except Saturdays, but in some cases the sessions are held at other times between the hours of 8.30 a. m. and 3 p. m.

The tuition fee for the entire instruction, exclusive of ironing and tailoring, foreign languages, stenography and typewriting, and cooking, is 50 pfennigs (12 cents) per month. Pupils taking either ironing or tailoring in connection with other studies pay 1 mark (24 cents) per month, and those taking both in connection with others pay 1.50 marks (36 cents) per month. The tuition for instruction in foreign languages is as many marks per half-year term as there are hours of instruction per week. Tuition for instruction in stenography and

typewriting is 50 pfennigs (12 cents) per month each. For the course in cooking a fee of 4 marks (95 cents) per half-year term is charged.

The total attendance at the nine schools was 3,476 during the summer of 1900 and 3,823 during the winter term of 1900–01.

SCHOOLS OF THE LETTE SOCIETY, BERLIN.

The Central Society for the Welfare of the Laboring Classes (*Centralverein für das Wohl der Arbeitenden Klassen*), founded in Prussia in 1844, decided in 1865 to take steps to provide women with better opportunities for earning a livelihood. This resulted in the organization in Berlin of a society with this special object in view (*Verein zur Förderung der Erwerbsfähigkeit des Weiblichen Geschlechts*). It proposed:

(1) The removal of the obstacles and prejudices in the way of female employment; (2) the fostering of educational institutions for the commercial and industrial education of females; (3) furnishing information regarding opportunities for learning trades, and securing situations and help in so far as existing institutions were inadequate; (4) the establishment of women's exchanges for the exhibition and sale of women's handiwork and other artistic products; (5) the protection of women against harm, either morally or otherwise, especially by giving information regarding suitable lodging houses.

In accordance with this programme, the society established in Berlin a commercial school, an industrial school, a school for the training of ladies' maids, a training school for house servants, a housekeeping school, a school for training teachers of industrial schools, a school for compositors, and a school of photography.

The industrial school comprises fourteen independent courses, as follows: (1) A theoretical and practical course in garment making, 4 months; tuition, 1 to 3 months, 15 marks ($3.57) per month; 4 months, 50 marks ($11.90); (2) a theoretical and practical course in garment cutting, three months; tuition, 15 marks ($3.57) per month; (3) machine sewing, 2 months; tuition, first month, 12 marks ($2.86), second month, 6 marks ($1.43); (4) preparatory course for the State teachers' examination in sewing, knitting, etc. (*Handarbeit*), 7 months; tuition, 67.50 marks ($16.07); (5) course in hand sewing, mending, artistic darning, linen embroidery, etc.; tuition, 5 marks ($1.19) per month; (6) millinery, 4 months; tuition, 48 marks ($11.42); (7) artificial-flower making, 4 months; tuition, 48 marks ($11.42); (8) ladies' hairdressing, 2 months; tuition, 24 marks ($5.71); (9) washing and ironing, 3 months; tuition, 36 marks ($8.57); (10) lace making, 1 month, 12 marks ($2.86); (11) cooking and housekeeping, 3 months; tuition, 75 marks ($17.85); (12) fruit and vegetable preserving, 1 month; tuition, 10 marks ($2.38); (13) course for teachers of cooking and housekeeping schools, 1 year; tuition, 400 marks ($95.20); (14) school of systematic instruction in all artistic needlework; tuition, 6 marks ($1.43);

ornamental drawing and coloring, designing patterns for art embroidery, etc., tuition, 15 marks ($3.57) in summer and 20 marks ($4.76) in winter; industrial art division, tuition, 6 marks ($1.43) per month; art embroidery by means of the sewing machine; tuition, from 1 to 3 months, 9 marks ($2.14) per month and every subsequent month 6 marks ($1.43). The total attendance at all these courses in 1897 was 1,738 pupils.

In the training school for ladies' maids the subjects taught are sewing, knitting, etc., machine sewing, ironing, lace making, tailoring, millinery, and hairdressing. The length of a course is 7 months; tuition, 159 marks ($37.84). There were 15 graduates from this school in 1898.

In the training school for house servants the minimum age of admission is 16 years. The subjects taught are sewing, knitting, etc., machine sewing, cooking, tailoring, ironing, and millinery. The length of a course is 6 months; tuition, 179 marks ($42.60). In 1898 there were 95 graduates from this school.

Training school for teachers of industrial schools: The subjects taught are preparation for the teachers' examinations, art needlework, ornamental drawing, garment cutting, machine sewing, tailoring, millinery, pedagogy, bookkeeping, ironing, and lace making. The minimum age for admission is 18½ years. The course lasts 16 months; tuition, 297 marks ($70.69). In 1898, 35 graduates passed the State teachers' examinations.

The school of photography furnishes practical exercises in drawing, perspective, retouching, painting, bookkeeping, chemistry, and English. The course covers one year. The tuition fee is 200 marks ($47.60). In 1897 there were 63 pupils in attendance.

In the school of housekeeping instruction and constant practice are given in household duties as well as in women's handiwork. In addition the general branches taught in the elementary schools are continued, and instruction is given in gymnastics, singing, and the Fröbel system. In 1898, 157 pupils were in attendance.

A school for female compositors was founded in 1875. In 1898 it had an attendance of 27.

VICTORIA CONTINUATION SCHOOL, BERLIN.

This is a private school, founded in 1888, for the purpose of affording to young women an opportunity to obtain a practical training for mercantile, industrial, and household occupations. It has day and evening classes.

Courses of instruction given in the evening school are mostly from 4 to 6, 6 to 7, and 7 to 8 o'clock, and are as follows: German, arithmetic, bookkeeping, business composition, industrial drawing, hygiene, sewing, knitting, etc., mending, singing, gymnastics, tailoring, garment cutting, machine sewing, ironing, cooking, and Fröbel work.

The day school is in session from 8 a. m. to 6 p. m. The subjects

taught are German, French, and English; single and double entry bookkeeping, business arithmetic, commercial science, penmanship, stenography, typewriting, machine embroidery, sewing, knitting, etc., artistic needlework, industrial drawing, millinery, and tailoring.

In the evening school the tuition fee for machine sewing, garment cutting, and ironing is 1 mark (24 cents) per month for each subject; for cooking, 6 marks ($1.43), and for the other branches, 1 mark (24 cents). In the day school tuition is from 3 to 12 marks ($0.71 to $2.86), according to the number of branches taken up. An entrance fee of 50 pfennigs (12 cents) is required in both the evening and day schools. Total or partial remission of tuition fees may be granted in meritorious cases. The attendance at this institution was as follows: Evening school—summer, 1900, 211; winter, 1900–01, 263. Day school—summer, 1900, 391; winter, 1900–01, 451.

TRADE AND CONTINUATION SCHOOL FOR BAKERS' APPRENTICES, BERLIN.

This school is conducted under the auspices of the bakers' guild of Berlin, in the rooms of one of the public schools. Instruction is given on Wednesdays from 3 to 5.30 p. m. There are two divisions—a continuation class and a trade class. In the former the instruction comprises arithmetic, German, and composition, and in the latter chemistry and bookkeeping. The total attendance was 183 in the summer of 1900 and 220 in the winter of 1900–01.

TRADE SCHOOL FOR BARBERS AND HAIRDRESSERS, BERLIN.

This school is maintained by the State, the city, and the guild of barbers and hairdressers. It is in session from the end of September until the end of April. Instruction is given on week days, except Saturdays, from 2 to 6 p. m. Two hours per day are devoted to each class, except on Wednesdays, when each class is in session four hours. A special course in surgery, for journeymen and masters, is held on Tuesdays from 6.30 to 9 p. m. The regular instruction comprises shaving, hair cutting and hair dressing, wig making, and ladies' hair dressing. The tuition per half-year term is 3 marks (71 cents) for apprentices and 6 marks ($1.43) for journeymen, for shaving, hair dressing, and wig making; 15 marks ($3.57) for ladies' hair dressing, and 10 marks ($2.38) for the lectures in surgery. The total attendance in 1900 was 435.

TRADE SCHOOL OF THE GUILD OF BASKET MAKERS AND WICKERWORKERS, BERLIN.

This school was organized in 1890 by the guild of basket makers and wickerworkers. It is maintained by the guild, but receives financial aid from the State and the city. Instruction is gratuitous for the

apprentices, but journeymen and adult workmen must pay fees of 4 marks (95 cents) a semester. All the guild members require their apprentices to attend the school. Apprentices of nonmembers can attend when there is room for them. Instruction is given on Sundays from 9 a. m. to 1 p. m. The school offers four courses, which relate respectively to ordinary basket making and general wickerwork; making of small wicker furniture; making of large wicker furniture; fine and artistic wickerworking. In the summer term of 1900 the attendance was 19; in the winter term of 1900–01 it was 21. The expense of conducting the school for the year 1898–99 was 2,309 marks ($550), 1,520 marks ($362) of which was for instructors' salaries.

TRADE AND CONTINUATION SCHOOL FOR BLACKSMITHS, BERLIN.

This school is conducted in one of the public-school rooms. It has two divisions—a continuation class and a trade class. Instruction is given on Sundays from 8.30 a. m. to 12.15 p. m., and on Wednesdays from 7 to 9 p. m. The Sunday classes are in session two hours each, and the evening classes one hour each. The continuation course consists of German and composition, arithmetic, and drawing with compasses. The trade course comprises trade drawing and theoretical instruction in horseshoeing. The total attendance was 134 in the summer of 1900, and 150 in the winter of 1900–01.

TRADE SCHOOL OF THE GUILD OF BOOKBINDERS, BERLIN.

This school is supported by the city and by the bookbinders' guild. It was founded by the guild, but after a few years' existence as a private institution its utility was recognized and the city gave it liberal financial assistance in return for a controlling voice in the management of the school. The courses are given on week-day evenings and Sunday mornings. The workshops of the Berlin bookbinders close at 6 p. m., but some of them allow their apprentices who attend the school to stop work at 4. The attempt to secure a half day for the apprentices to enable them to attend the school during the week has not yet been successful. About one-third of the pupils in the school are journeymen and the rest are apprentices. The special value of the school is due to the fact that in private establishments the division of labor in the trade has progressed so far that it is no longer usual for an apprentice to have an opportunity to perform the complete operation of bookbinding during his term of indenture. The school is supplied with workshops, and gives training in every branch of the trade. Applicants for admission must show that they have had two years' experience in the trade. The purpose of the school is not to make binders, but to furnish those already in the trade an opportunity to obtain greater skill in their work.

The underlying principle of the instruction given in the school is that no specialization shall be allowed until the pupil has had a thorough grounding in all the various branches in which the trade is so completely divided. The first course is on general bookbinding. The prospectus of the school describes the work as follows:

General bookbinding: General explanation of the purpose and aim of the course of instruction; the general preparation of books for binding, including treatment of plates and such matter as is intended to be fixed on guards; the beating and rolling of books, arranging the sections and sawing the cuts for 3, 4, and 5 cords; selection of thread for the various sizes of sections; tightening cords, pasting, fraying cords, gluing the book; explanation of the cutting tools and the cutting machines; trimming the book with tools and machines; hammering the backs into rounded forms and pressing the books; the various kinds of edges; selection and preparation of boards for board bindings, half and full linen bindings; selection of the kind of back and treatment of same; setting the back and the boards for board bindings; making the covers for half and full linen bindings, and fixing the sides for the same; selecting and working the boards for half-morocco bindings; setting on the bindings with the various kinds of sewing; treatment of the book after putting on the boards; selecting and cutting the backs; selecting and distributing the cords to be used; the most usual kinds of leather, and methods of treatment in working with it; shaving and thinning it; general discussion of materials; inlaying leather in leather bindings; making leather corners for half-leather bindings; selection of covering papers; use and combination of the various colors; covering and pasting a half-leather binding; cutting the materials; selection of bindings by the pupil himself; lecture by the instructor on the various pastes and glues, their use and method of working; lecture on the appearance and form of well-bound books; lecture on making a full-leather binding; making various kinds of cardboard boxes; mounting of maps and plans on linen and cardboard; priming and varnishing the same; preparing a binding selected by the teacher and which shall serve as a test of ability and be the basis for a certificate.

Gilding: Cloth backs, treatment for blind and gold tooling; leather backs, treatment of the various colors and kinds of leather for blind and gilt tooling; titles and stamping; treatment of the various kinds of type; combining various kinds of type for back titles; names of the various kinds of gilding; decorating book covers; introduction into the use of the stamps and curved lines; preparing the glair for use on cloth and leather.

Edge gilding: Making the edges of a book; preparing the glair and the ground for gilt and colored edges; scraping the edges; polishing; gilding; decorating the edges; preparing edges of several colors; general discussion of the preceding and problems on the same.

Blank-book making and marbling: Blank-book making—Folding and preparing for sewing; the various methods of sewing with thread and wire; cutting the books; pressing; various kinds of edges, colored, marbled, spotted, and grained; setting on the covers; forming the edges; the various kinds of backs, solid, broken, and spring backs, and discussion of the same; covering and finishing the books; interleaving with blotting paper; indexing. Marbling the book edges—General discussion of the art of marbling; marbling apparatus; preparing the gall, choosing and preparing the colors, making the ground and testing the colors; the various kinds of marbling, small, vein, and Turkish marbling, fancy edges; removing marbling.

Artistic binding: Production of artistic bindings; half and full leather bindings after the best French and English styles; further instruction in decorative work for those who have taken the course in gilding; back-title work and decoration; decoration

of sides; leather inlaying (leather mosaics), and gilding the same; coloring, spotting, and marbling leather and preparing the colors, mordants, and materials therefor.

Gold tooling: Explanation of use of tools, preparing the paste and gluing materials; printing and tooling on raw materials, and proper placing of the stamps and dies; blind tooling on cloth-covered books; setting up letters in title stamps; exercises in blind tooling on book covers; preliminary title stamping and treatment of same up to gilding; instruction in placing and stamping the gold; exercises in preliminary stamping of lines, corners, and titles, and later the stamping of the same in gold; preparing matrices for relief work and blind tooling; color stamping; executing tooling of all kinds from specimens and from designs of the pupil himself on paper, cloth, leather, silk, and velvet.

The number of pupils in attendance during the summer term of 1900 was 71, of whom 17 were journeymen; during the winter term of 1900–01 the number was 92, of whom 32 were journeymen. Apprentices of guild members pay no tuition fee. Apprentices of others pay 5 marks ($1.19) per term. Journeymen pay 9 marks ($2.14) per term. During the term each pupil generally makes three or four bindings which he is allowed to keep, though the cost of the leather used is charged against him.

In 1898–99 the total expense of the school was 4,224 marks ($1,005) of which amount 2,280 marks ($543) was paid for instructors' salaries. The receipts were as follows: Tuition fees, 529 marks ($126); contribution from the guild, 500 marks ($119), and from the city, 3,195 marks ($760).

SCHOOL FOR CABINETMAKERS, BERLIN.

This school, including the school for turners, which was united with it in 1896, was organized by the guild of cabinetmakers of Berlin, but is now under the supervision of the Prussian authorities. It is one of the most important of the trade schools that owe their origin to guild action. The institution is divided into a central school and eight branches located in different quarters of the city. The direction of the school and its branches is intrusted to an industrial committee of the city named by the city authorities and consists chiefly of leading members of the guild of cabinetmakers.

The purpose of the school is to offer instruction in all the branches of artistic woodworking. The courses include technical or trade drawing and designing, modeling, carving, free-hand drawing, styles, and the technology of woods. The following is a brief summary of the various courses.

Free-hand drawing: At the beginning, the drawing of simple decorative forms; then conventionalized plant forms and their arrangement as surface ornaments, as frieze, as checkerwork, and surface carving.

Projection drawing: Geometrical drawing is used as an introduction to this class of drawing; front, rear, and side elevations of bodies; diagonal elevations, cross sections, and unwindings; construction of moldings, etc.

Wood joining and styles: Drawing of the important joints, mortises, dovetails; the various kinds of floorings and their joints; head, intermediate, and foot casings; columns, trusses; supporting and other ornaments.

Technical drawing: Drawing of building and cabinet woodwork in working drawings and sketches from given models and samples, as well as from suggestions of the teacher; designing and sketching from the specimens of furniture in the public collections, and independent designing of work for building operations and for furniture making; drawing of stairs; drawing of mountings; furnishing of rooms; estimating various jobs.

Drawing from plastic ornaments: Drawing of ornaments from plaster casts, wood carvings, etc., in outline and with shadows; shadows are drawn in various styles, but for the most part in pencil.

Perspective and shading: Representation in perspective of bodies, parts of furniture and whole pieces, as well as shading in its application to cabinetwork.

Chemistry: Lectures, illustrated by experiments, on staining, coloring, and polishing woods; the making of stains and colorings; properties and preservation of the principal kinds of wood, etc.

Modeling and wood carving: Modeling from casts of leaves and other parts of plants from conventionalized plastic specimens and from photographs and drawings. In connection with this, wood carving in plain and high relief. The latter work is based on ornaments used in the trade.

The classes are held every week-day evening after working hours and on Sunday from 8 a. m. to 1 p. m. On Wednesdays classes in trade drawing for apprentices are held from 8.30 a. m. to 12.30 p. m. and from 1.30 to 5.30 p. m. The tuition fees for the first term in technical drawing are 4 marks (95 cents) and for each additional term 2 marks (48 cents). The tuition fee for each of the other courses is 2 marks (48 cents) per term. Needy students receive free tuition, though their number may not exceed 10 per cent of the paying students.

For the last year for which the figures are available, 1898–99, the total expense of running the school was 28,518 marks ($6,787). The amount received from students' fees was 5,334 marks ($1,269).

In the summer term of 1900 the total number of students in attendance at the main school and its branches was 779; in the winter term of 1900–01 the number was 1,145.

TRADE AND CONTINUATION SCHOOL OF THE GUILD OF CHIMNEY SWEEPS, BERLIN.

This institution is maintained by the State, the city, and the guild. It has three classes, a lower and higher class for apprentices and a class for journeymen. Instruction for apprentices is given on Sundays from 10 a. m. to 12 m., and on Saturdays from 5 to 7 p. m. The journeymen's class is held from 9 a. m. to 1 p. m. on Sundays. Each class is in session four hours per week. The instruction comprises drawing, German, arithmetic, and physics, with special reference to chimney sweeping. Journeymen and nonresident apprentices pay a tuition fee of 4 marks (95 cents) per half-year term. Resident apprentices pay no tuition fee. The total attendance was 82 in the summer of 1900 and 74 in the winter of 1900–01.

TRADE SCHOOL FOR CONFECTIONERS, BERLIN.

This institution is maintained by the association of confectionery proprietors of Berlin. The classes are held in the rooms of one of the public schools from 7.30 to 9.30 p. m. on Mondays and Thursdays from January 15 to October 15. The instruction consists of decorating tarts, various styles of lettering in glazed sugar, ornamental work in sugar, making flowers and other objects in sugar and painting and decorating the same, modeling objects in marchpane, theoretical instruction in regard to the art of baking, conserving fruit, business management, etc. The tuition fees are 4 marks (95 cents) for apprentices and 6 marks ($1.43) for journeymen per quarter. The attendance in 1900 was 78.

TRADE SCHOOL FOR GARDENERS, BERLIN.

This institution is maintained by the city and by the Prussian Association for the Advancement of Garden Culture. The classes are held in the rooms of one of the public schools from 7 to 10 p. m. on Tuesdays, Wednesdays, and Fridays, and from 9 a. m. to 12 m. on Sundays. The class instruction is mostly in the winter time, exercises in surveying being conducted in the summer. The instruction comprises German, arithmetic, drawing, bookkeeping, botany, fruit and vegetable culture, study of soils and fertilizers, and plant culture. The tuition fee is 3 marks (71 cents) per half-year term. The attendance was 12 in the summer of 1900 and 112 in the winter of 1900–01.

TRADE SCHOOL OF THE GLAZIERS' GUILD, BERLIN.

This school is maintained by the State, the city, and the guild. The classes are held in the rooms of one of the public schools on Tuesdays and Fridays from 7.30 to 9.30 p. m. from October 6 to March 31. The instruction comprises geometric trade drawing, i. e., patterns for glazing work; cutting according to working drawings, glazing in cames, making picture frames, and framing pictures. Apprentices pay no tuition fees. Journeymen pay 5 marks ($1.19) per half-year term. The total attendance in 1900 was 71.

SCHOOL FOR MASONS AND CARPENTERS, BERLIN.

In this school apprentices and journeymen masons and carpenters receive such instruction as they can not get in the shop or in the usual building operations. The school comprises, first, a preparatory class for both trades, and then a series of classes for each of the trades, covering five half-year terms, so that a student requires three years to complete the full course.

The school is a municipal institution, to the support of which the federated guild of master builders, masons, and carpenters contributes. The instructors are all practical men, who have had actual experience

in the various branches which they teach. The instruction is given in terms of twenty weeks each (on twenty Sundays) from 9 a. m. to 1 p. m., and is as follows:

PREPARATORY CLASS.

Plotting angles of the various sizes met with in practical work; construction of regular triangles and polygons, of curved lines (semicircles, segments, etc.). Determining the center of gravity of plane figures; locating center of segments of arches from given dimensions. Explanation of simple bodies with the assistance of models, drawing of ground plans, side views, etc., of such bodies (cubes, prisms, pyramids, etc.). Determining slanting sections through several of these bodies (with reference to plotting out joints in beams, diagonal sections, arches, etc.).

Vertical and horizontal sections through hollow bodies and their representation in various elevations as the basis for the study of sections through wall openings. Drawing of cross sections of bodies which resemble the simple roof and arch forms; construction of vertical and diagonal sections in places where they occur in practical work. Explanation of the metric system; the scales on which working drawings are usually made.

CLASSES FOR MASONS.

First half year (20 Sundays): Explanation of the rules for masonry bondings and their application to problems for work on the drawing board (with the aid of models); laying walls of various thicknesses in block bond and cross bond; laying door and window corners, right-angled and acute-angled masonry work, round and cornered columns, walls with isolating spaces and with chimney bonds; wall arches (round arches, door and window arches) with bonds; masonry for foundation work; designing an inside and outside view of a window opening with a parapet, a cellar light opening with lunette, and a cellar opening with stairs.

Second half year (20 Sundays): The development of the principal arch forms; vaulting Prussian coping between walls, arches, and supports, with dovetailing, etc.; arching a dam with and without abutments; laying and arching a lunette; scaffolding; construction and arching in of a spherical vault.

Third half year (20 Sundays): Review of the development of the principal arch forms and their effect on the supporting walls and columns; construction and arching in of the spherical vault in its various forms similarly with the cross vault and cross arch; connecting the various arch forms and the static principles in relation thereto.

Fourth half year (20 Sundays): Construction of the staircase according to the plan usually followed in Berlin, both in stone and brick, with special reference to the city building laws. This work is arranged: (1) Copings with supports at different heights between the floors; raised copings between joists; laying the steps; bonds; (2) rules to be observed in setting and placing steps in straight and winding staircases; constructing ribbed and other moldings with the size of the stone given and the kind of bond specified; bracing; combining stone and brick work.

Fifth half year (20 Sundays): Instruction as to work on the building site. The work includes: Foundation ditches, water supply, working out the building lines, laying the foundations, measuring the height, laying walls, columns, chimneys, and arches; designing and constructing the various arches; erecting scaffolding; bracing work, laying and constructing supports; measuring and placing cut stone; preparatory work for the various kinds of arches; joining the stonework; masonry work for stairs, and joining the work; erection of scaffolding by using poles, bolts, etc.; introduction to work on polished walls, ceilings, façades, etc.; the important features of the building laws.

CLASSES FOR CARPENTERS.

First half year (20 Sundays): Explanation of timber work; taking measurements for buildings and preparing joists; framework walls and wood joints used; beams; strengthening the beams with cross pieces, saddle boards, and head bands.

Second half year (20 Sundays): Explanation of roof forms; building roofs; lengthwise and cross work; arranging timbers; the various roof trusses; hanging and suspension work.

Third half year (20 Sundays): Hip roofs; arranging girders for hip roofs; rib and other rafters; determining crosscuts and wood lengths; ironwork and bracketing; various ways of joining rafters lengthwise; construction of casings in wood.

Fourth half year (20 Sundays): Construction of wooden stairways of all kinds, including details.

Fifth half year (20 Sundays): Instruction in matters pertaining to actual building work. It covers preparatory and completing operations in erecting arches of various kinds; the methods of joining; roofing; rafters; stairways; the important features of the building regulations; measures for preventing dry rot.

An interesting feature of the school is the optional course on "first aid to the injured" (*Samariter kursus*); this is given between 12 m. and 1 p. m. on class days by a practicing physician to such of the more mature students who are able to keep up the regular class work in addition to this instruction. Journeymen who are not attending the school may also attend this course, for which no charge is made. Those who satisfactorily complete the course receive a medicine chest.

The school is open to all apprentices and journeymen in the trades of masons and carpenters. The fee is 5 marks ($1.19) a term, though even this may be remitted in the case of needy students.

For the convenience of the pupils the school is divided into two sections, located in different parts of the city. The attendance in the classes for masons was 165 in the summer of 1900 and 220 in the winter of 1900–01. The number attending the classes for carpenters in the summer of 1900 was 53 and in the winter of 1900–01 it was 56.

In the year 1898–99, the last year for which financial returns are available, the total expense of conducting the school was 8,651 marks ($2,059). This was covered by 2,010 marks ($478) received from tuition fees and 1,436 marks ($342) contributed by the guild of masons and carpenters already mentioned. The balance, 5,205 marks ($1,239), was paid by the city. Of the total expense incurred for the school, 6,536 marks ($1,556), or about 75 per cent, was paid for instructors' salaries.

TRADE SCHOOL FOR PAINTERS, BERLIN.

This institution is maintained by the State, the city, and the painters' guild of Berlin. The school is in session from November 1 to March 1. The evening classes are held from 5 to 8 on week days and the day classes from 1.30 to 4 p. m. on week days and from 9 a. m. to 12 m. on Sundays. Instruction is also given on 20 Sundays during

the summer half-year term. The instruction comprises drawing in outline from plaster casts, from nature, and from copy, shading with the stump, and painting from plaster casts. No tuition fees are charged for apprentices of members of the guild. Journeymen pay 9 marks ($2.14) per half-year term. The attendance was 19 in the summer of 1900 and 257 in the winter of 1900–01.

TRADE SCHOOL FOR PAPER HANGERS AND DECORATORS, BERLIN.

This school is maintained by the State, the city, and the paper hangers' guild. Its purpose, according to its prospectus, is to give apprentices an opportunity to secure instruction in those branches of their trade which the workshop can not give them. Instruction is given on week day evenings from 7 to 9 o'clock and on Sundays from 9 a. m. to 1 p. m.

The work is divided into three courses, namely, styles of decoration, technical instruction, and technical drawing as follows:

Decoration: Constructing, estimating, and drawing patterns of styles which are used in the trade; foldings, rosettes, etc., from given measurements in one-tenth of natural size; measurements and patterns of the various styles of canopies; curtains for beds, bay windows, etc.; projections and perspective of tents, with patterns for canvas for the same.

Technical instruction: Lectures on decoration, paper hanging, etc., problems in technical matters; elementary work in decorative patterns, construction of simple geometric figures; drawing of flat lambrequins and transferring them according to given scales; practical execution of free hand sketches of decorations for windows, doors, mirrors, easels, canopies, corners of rooms, etc., in all varieties of materials; decorations with flags, together with explanations of the various flags of the Empire; hanging curtains in various styles; draping straight and curved surfaces in various styles.

Technical drawing: Outline drawing and shading from samples of material and free-hand sketches of decorations; original designs of decorations from given specifications.

Apprentices who have finished half their time of indenture are required by the guild to take the courses offered by the school. Others engaged in the trade also have the right to attend. The apprentices pay 2 marks (48 cents) for each half-year term, while others pay 10 marks ($2.38) per term. In the summer term, 1900, the attendance was 195; in the winter term, 1900–01, it was 205.

The total expense of running the school for the year 1898–99 was 8,769 marks ($2,087), 7,280 marks ($1,733) of which was required for instructors' salaries. The tuition fees amounted to 1,330 marks ($317); the guild paid 500 marks ($119), the State 2,392 marks ($569), and the city 4,547 marks ($1,082).

TRADE SCHOOL FOR PHOTOGRAPHERS, BERLIN.

This school is supported by the city and by the photographic society of Berlin. Instruction is given on four week-day evenings from 7.30

to 9.30 and 10 and on Sundays from 11 a. m. to 1 p. m. The subjects taught are picture and negative retouching; drawing from photographs, from life, and from plaster casts; experimental chemistry; the optics of photography, and water coloring and painting photographs. The attendance in the summer of 1900 was 62 and in the winter of 1900–01 was 87.

TRADE AND CONTINUATION SCHOOL OF THE POTTERS' GUILD, BERLIN.

This school is maintained by the city and by the potters' guild of Berlin. It is conducted in the rooms of one of the public schools. Instruction is given on Mondays and Thursdays from 6 to 8 p. m. during the winter half year only, and consists of theoretical trade lectures, trade drawings from plaster and wooden models, arithmetic, and German. The attendance in 1900 was 49.

TRADE SCHOOL FOR PRINTERS' APPRENTICES, BERLIN.

This school is supported by the Berlin Printers' Union and by subsidies from the city. Instruction is given on Tuesdays and Fridays from 7 to 9 p. m. in the rooms of one of the public schools. It has two divisions—one for compositors and one for printers. In the former instruction is given in typesetting in German, Latin, French, English, and Greek, arithmetic, theory, and drawing. The division for printers comprises instruction in German, arithmetic, physics, mechanics, drawing, and theory. The tuition is 3 marks (71 cents) for apprentices of members of the union and 4.50 marks ($1.07) for all others. The attendance in the summer of 1900 and in the winter of 1900–01 was 710.

TRADE AND CONTINUATION SCHOOL OF THE GUILD OF SADDLERS, TRIMMERS, AND TRUNK MAKERS, BERLIN.

This school is maintained by the guild, but occupies rooms in one of the public schools. Instruction is given on four week-day evenings from 7 to 9 and from 8 a. m. to 1 p. m. on Sundays. The instruction comprises trade drawing, theory, bookkeeping, and practical work in trunk making, harness and saddle making, and carriage trimming and upholstering. The tuition fee is 2 marks (48 cents) for apprentices and 6 marks ($1.43) for journeymen. The attendance in the summer of 1900 was 127 and in the winter term of 1900–01, 125.

TRADE AND CONTINUATION SCHOOL FOR SHOEMAKERS, BERLIN.

This institution comprises a continuation school and a trade school, each of which is separately conducted in the rooms of a school building. It is supported by the State, the city, the association for free Sunday schools, and the shoemakers' guild. Instruction is given on

Mondays and Thursdays from 7.30 to 9.30 p. m., on Tuesdays from 7 to 10 p. m., and on Sundays from 9 a. m. to 12 m. In the continuation school the subjects taught comprise drawing, bookkeeping, arithmetic, reading, and German, and in the trade school technical lectures and study of materials. Apprentices pay no tuition fees, but masters and journeymen pay 1 mark (24 cents) per quarter. The attendance was 112 in the summer of 1900 and 132 in the winter term of 1900–01 in the continuation school, and 36 in the summer of 1900 and 76 in the winter term of 1900–01 in the trade school.

TRADE AND CONTINUATION SCHOOL FOR TAILORS, BERLIN.

This institution embraces two divisions—a continuation school and a trade school. The classes are held in the rooms of one of the public schools on Mondays from 4 to 8 p. m. The continuation course includes bookkeeping, correspondence, arithmetic, and German, and the trade course comprises trade drawing, technical instruction, and shop-work. The work done in the trade classes includes the making of garments, ironing, drawing individual parts of garments, body forms, etc. The tuition fee is 1 mark (24 cents) per quarter. The attendance was 137 in the summer of 1900 and 167 in the winter of 1900–01.

TRADE SCHOOL FOR TINSMITHS, BERLIN.

This institution is maintained by the city and by the tinsmiths' guild. The classes are held in the rooms of one of the public schools. The instruction comprises trade drawing, arithmetic, geometry, and architecture. There was an attendance of 122 pupils in 1900.

TRADE SCHOOL OF THE GUILD OF WAGON MAKERS AND WHEELWRIGHTS, BERLIN.

This institution is supported by the State, the city, and the guild. The classes are held from 5 to 9.30 p. m. on Wednesdays, from 7.30 to 9.30 p. m. on Fridays, and from 8 a. m. to 12 m. on Sundays, in the rooms of one of the public schools. The instruction comprises trade drawing, lectures on trade subjects, and practical work. Apprentices pay no tuition fee, but journeymen are charged 2 marks (48 cents) per half-year term for drawing instruction and 6 marks ($1.43) for shop-work. The attendance was 53 in the summer of 1900 and 64 in the winter term of 1900–01.

CHAPTER VIII.

TRADE AND TECHNICAL EDUCATION IN GREAT BRITAIN.

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TRADE AND TECHNICAL EDUCATION IN GREAT BRITAIN.[a]

INTRODUCTION.

The English elementary schools, which correspond to the primary and grammar grades in the United States, give some manual training. There are also finely equipped scientific schools, although scarcely any are as large as the Massachusetts Institute of Technology in this country. It is not the aim here to cover either of the above phases of education, but only the trade or technical training of artisans for their work. For reasons which will soon appear, there are scarcely any purely trade or apprenticeship schools that claim to give a boy all the trade instruction needed for him to become a journeyman, even aside from the attainment of speed, which work in the shops alone can give.

The New York Trade School, founded by Colonel Auchmuty in New York City to accomplish the above purpose, has no imitators in Great Britain on any considerable scale outside of a few art industries. Yet there are forty or fifty schools which, on a large scale, and some of them for many years, have given a close approach to trade instruction under the name of technical education. To understand just what is meant by this and to prepare the way for a consideration of the results and the present condition of such instruction, it becomes necessary to consider briefly the history of the movement.

For reasons which need not be considered here, about the only form of industrial education to be found in Ireland and Wales is agricultural or applied science. Certain national grants, which have been of much use in England, have not been so generously bestowed in Scotland, nor have they been so available for technical instruction, but there is a growing desire and expectation among Scotch educational authorities that a fund will soon be applicable to this form of education. Some instruction of this kind, largely in general engineering, is given in Edinburgh and Glasgow, as elsewhere noted, and some also in Dundee. It was in Scotland that the first step was taken for the technical education of artisans as far back as 1800. A physician, Dr. Birkbeck,

[a] The portion of this chapter relating to trade and technical education in Great Britain in general, from page 987 to page 1001, also the statement on pages 1142 to 1144 relating to the attitude of labor unions generally, was prepared for this report by Prof. E. W. Bemis after a study of the subject made during a personal visit to that country.

then lecturing in a Glasgow college, became so much interested in the intelligence and greed for learning manifested by the workingmen in a tinsmith's shop where he was buying some apparatus to illustrate his lectures that he arranged a course on physical science expressly adapted to the wants of mechanics. Mechanics' institutes, which owed their inspiration largely to him, were soon founded in many parts of Great Britain. The few that survived became the forerunners of some of the large modern technical schools, but in their original form they gave little technical instruction to artisans, save along the line of elementary scientific facts.

In 1851 the first World's Exposition at London aroused interest in technical education and furnished funds for the present headquarters at South Kensington of that and other departments of educational work. The science and art departments, instituted by the Government in 1853 and aided by its grants and oversight, helped to spread throughout the United Kingdom a general knowledge of elementary science, but ignored literature and language, and insufficiently appreciated technical and trade instruction.

In 1870 the first act of compulsory education was passed, 36 years after the first national grant for popular education, but it was not until about 1880, and immediately thereafter, that the first steps toward the modern technical education of artisans can be said to have been taken in any practical way.

The wealthy livery companies, or guilds, of London became alarmed lest their funds should be confiscated through the exposure of their misapplied endowments. Nearly all these companies thereupon united in the organization, in 1878, of the City and Guilds of London Institute, for the promotion of technical education throughout Great Britain. In 1883 they opened the Finsbury Technical College, erected at a cost of about $175,000, and, what is more to the present purpose, secured the attendance of 600 artisans in evening classes, where more or less technical instruction bearing on their daily work was introduced. More important was the establishment by the institute of examinations, prizes, and other aids to technical classes throughout the country.

A second factor in the problem now appeared, in the moving into its present quarters in Regent street of the first polytechnic institute, founded by Mr. Quintin Hogg, at an expense of about $400,000, and combining, in a remarkably successful way, the social and the recreative sides with the educational. Classes for the special instruction of artisans in practical lines were such a successful feature of this institution that it became a model, in this as well as in its recreative features, for the eight other polytechnics subsequently established in London.

A third agency which furnished funds for many of these polytechnics and other technical institutions in London was the charities act. It

diverted an income of about $400,000 a year from useless charities, which dated back many years, to educational work of a more or less technical character for wage-earners.

A fourth factor, in the early eighties, was the scare over foreign competition, particularly at that time from Germany. This led to the report, in 1884, of the Second Royal Commission on Technical Education. A very important feature of this report was the chapter in Volume II on Technical Education in the United States and Canada, by William Mather, M. P., of Mather & Platt, who had already begun the famous technical school which is still kept up for their apprentices in their large engineering works at Salford. Mr. Mather was greatly impressed with the liberal support given to the advanced scientific schools in the United States and with the large attendance; also, with the fact that the children remain in the elementary and high schools fully two years longer on the average than in England. In other parts of the report the technical and trade schools on the Continent were fully described.

In 1888 came the organization of county councils, which furnished some of the machinery for the subsequent development of technical education for the masses on a large scale. It was not until 1889, however, that the technical instruction act was passed, which, with the customs and excise act of 1890, rendered it possible to use national and local taxation for the technical education of artisans.

The act of 1889, permitting local taxation for technical education, provided that local authorities might tax themselves a "penny in the pound," which would yield nearly £700,000 ($3,406,550). Scarcely any communities, however, levied this tax at first, and at present only about one-ninth as much tax is collected under this law as might be secured. The importance of the act lay in its preparing the way for the use of the funds rendered available by the act of 1890. The latter act undoubtedly would not have been passed had it not been preceded by the act passed the previous year.

In 1890 the Government was face to face with a successful league of the prohibitionists and the liquor interests to defeat the Government's proposition for buying up and canceling a large number of liquor licenses. It was near the close of the session. The bill setting aside for the proposed purchase of licenses a certain proportion of the excise tax on the sale and manufacture of liquor had already gone too far to be easily abandoned. At the last moment it was suggested that the funds in hand might be yearly handed over to the local authorities of the Kingdom either to use for technical education or to relieve from local taxation, as might be deemed best by the community. In that form the bill was passed. With the slow increase of the revenue from this liquor tax has come a corresponding increase

of what is usually known as the residue grant, or the customs and excise grant, to the local authorities. In England the local authorities—the counties and county borough councils—receive about £840,000 ($4,087,860) from these sources. About £75,000 ($364,988) is used to relieve the rates, in some districts, and this approximately balances the £75,000 of local tax raised in other districts to supplement the national grant. Of the £75,000 thus allowed for the relief of the rates, or taxes, £42,000 ($204,393) is used in this manner in London, but on the other hand that city receives more funds for technical education from the guilds and old charities than do other parts of England. This residue grant, popularly known as the beer money, or the whisky money, has been humorously described as "drinking ourselves into a higher education," "making the vices pay for the virtues," or "the payment by the drinkers to the thinkers." Public sentiment is rising in favor of a larger use of the powers of local taxation for technical education, and for broadening its scope in some directions and making it more practical in others.

Over forty so-called technical institutes and polytechnics of considerable size are now flourishing and steadily growing in England and Scotland, while there are many smaller ones, and new institutions are being started yearly.

An investigation in 1898, the results of which were published in the Eleventh Annual Report of the National Association for the Promotion of Technical and Secondary Education, revealed the fact that the cost of buildings and equipment of the technical institutions in 42 English county boroughs was £1,173,496 ($5,710,818), and of the land £85,536 ($416,261). The Twelfth Annual Report, in 1899, gave the total capital expenditure for 272 municipal and other technical schools as £2,643,162 ($12,862,997). In 52 towns technical schools were under municipal management, and the number that are being transferred to municipal control is increasing each year.

CHARACTER AND EXTENT OF TECHNICAL EDUCATION IN ENGLAND.

The technical instruction act of 1899 declared that "the expression 'technical instruction' shall mean instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employments. It shall not include teaching the practice of any trade, or industry, or employment, but, save as aforesaid, shall include instruction in the branches of science and art, with respect to which grants are for the time being made by the department of science and art, and any other form of instruction (including modern languages and commercial and agricultural subjects), which may for the time being be sanctioned by that department by a minute laid before Parliament and

made on the representation of a local authority that such a form of instruction is required by the circumstances of its district. The expression 'manual instruction' shall mean instruction in the use of tools, processes of agriculture, and modeling in clay, wood, or other material."

The definition has been retained in all subsequent legislation of the general Government. The science and art department, which has been intrusted with the responsibility of interpreting the act, has sanctioned, one by one, every subject taught in the schools, except classics, as coming under the head of technical instruction. The result of this and other legislation has been that there are no secondary schools corresponding to our high schools, giving general culture, which are supported by public taxation in England, but there are a large number of these so-called technical schools which carry on two lines of instruction. One line is general scientific instruction with scarcely any literature, but with considerable manual training for those between the ages of about 14 and 17 who can afford to attend day classes. Such work is also conducted in evening classes. The instruction conducted in the evening attracts by far the larger number of students and comes nearer to being trade instruction. In some schools the practical instruction along trade lines is far more marked than in others. These evening classes, however, and a few day classes of a somewhat corresponding character, differ from what would be understood in America or the continent of Europe as distinct trade schools in that, while the instruction is both theoretical and practical and is intended to bear directly upon some particular trade in each case, the purpose is not to supersede the training of the workshop, but merely to supplement it.

The pupils, whose ages range from 14 to 50, but mostly from 15 to 30, are given lectures and text-book work on the application of science, drawing, and art to their particular trade, and in many, although still a minority, of the classes there is given the opportunity in a sort of workshop laboratory to handle all the tools and machinery and acquire a more thorough knowledge of all the processes of a trade than is attempted at the bench or in the factory. In their trades most of the workmen are obliged to specialize upon some one portion of manufacture. The schools aim to supply what the shops do not give and to keep the student abreast of the latest developments of invention and of the application of science to his trade. Of course, it is impossible in an attendance of 2 or 3 evenings a week of about 2 hours each for about 35 weeks in the year to gain the manipulative skill and speed which is obtained in the workshops and factories. It is conceded by some of the teachers of these technical classes that, with more time and money and a larger amount of direct workshop instruction in a trade where science and knowledge are more needed than manipulative skill,

the whole of the trade could be taught in the school; for example, in wood carving, engraving, inlaying, metal chasing, enameling, china painting, basket making, embroidering, artificial-flower making, etc., which require oversight, but no expensive tools. Such complete trade teaching, however, is not the aim of the present technical classes, yet they are thoroughly practical in character and come nearer to direct trade instruction than to manual training schools. The term "technical education" rather than "trade instruction" is preferred in England to describe this kind of work. Prof. Sylvanus P. Thompson, principal and professor of physics in the City and Guilds Technical College, declared in 1897 that "education is technical only as far as it is directed to the training of the individual in and for his business in life." Sir Philip Magnus, head of the entire work of the City and Guilds Institute, has stated that technical or special education of the engineer, the weaver, the cabinetmaker, etc., was to be placed alongside of the special education of the soldier, surgeon, lawyer, and schoolmaster. Each is equally technical, but he holds that there is a difference between practical trade teaching, which the technical schools are attempting, and teaching the practice of a trade, which is forbidden by the technical instruction act of 1889 and its amendments. English teachers often quote with approval the remark of a famous head of a continental technical school to the royal commissioners on technical education, "Pray do not call this a weaving school; it is a school of art applied to weaving."

In England it is held that legally, if not practically, trades can not be taught in a school, but it is held also that trades can not be taught without a school. The English educational instruction act of 1889, which declared that technical instruction in the meaning of the act "shall not include teaching the practice of any trade or industry or employment" is very loosely interpreted by the educational department of the Government. That department can not recall a half dozen instances in which any particular class suggested by local authority has been denied a share in the Government grant because of its violating this act. One case was given where the board of education refused to indorse the proposed teaching of two young ladies of bending metal into the ornamental forms for baskets. When a local council wanted to teach nursing, a prominent member of the Government suggested that this looked too much like teaching the practice of an industry or employment, and advised that they call it "teaching physics and medicine as applied to the nursing of the sick," and this more satisfactory form of wording was adopted, and nursing was taught just as contemplated. In a technical educational conference in 1897 the chairman held that there was no trouble about teaching anything desired even in the line of trade instruction under the act if the word "practice" be emphasized in the sentence—"It shall not

include the teaching of the practice of any trade," etc.—since any school might truly hold that it was not so much the practice it was teaching (the shop of course giving the practice) as it was the trade itself with just enough practice to fix the methods and principles of the trade.

The fees at these technical institutions have been little more than nominal. In London they are usually from $1 to $3 for the entire year's session of about 8 months. No school, so far as learned, except Bradford has undertaken to derive any income from the sale of articles made by the students. Donations in most cases have been in moderate amounts from many people and not in lavish sums from a few. The expensive laboratories and workshops have been a heavy financial burden. On top of this has come (what all in England seem to consider essential) the scheme of stimulating attendance and interest in educational work by a great number of prizes and extensive scholarships and fellowships, known abroad as scholarships and exhibitions. According to the regulations governing scholarships and exhibitions awarded by the Lancashire County Council, the chief distinction seems to consist in the fact that the former are valued at about £60 ($292) per annum and are good for a term not exceeding three years; while the latter are valued at £5 ($24.33) each, if for evening classes, and as high as £15 ($73) if for day classes, and are good for one year. In other words, exhibitions are a sort of short-term scholarship. A surprisingly large portion of every English catalogue is taken up with announcements of prizes offered for the next year and of prizes won during the year just past. This need of all the funds possible, and this eagerness for prizes, not only financially valuable, but widely honored throughout Great Britain, has furnished a peculiar opportunity to influence technical education in case any organization should come forward able to give prizes and grants for attending workshop classes.

Such an organization has been the City and Guilds of London Institute, previously referred to. It has so shaped its examinations and its influence as to have been decidedly the most potent factor during the last twenty years in the promotion of more strictly workshop trade classes than was apparently contemplated by the technical instruction act of 1889 or than the British board of education was naturally inclined to indorse. The institute in 1899 and 1900 distributed 103 silver and 156 bronze medals and gave money prizes of £477 10s. ($2,323.75) distributed over 59 subjects and over a large number of technical classes throughout Great Britain. The original donations by the Livery Companies of London to the institute amounted to £65,610 ($319,291), and it has an annual income from subscriptions of about £20,000 ($97,330). A large portion of this is

spent in supporting advanced technological and art work in its three London colleges, but in 1899–1900 it spent upon these technological examinations a gross sum of £7,272 ($35,389), and after deducting fees, a net amount of £5,508 ($26,805). The technological examinations began in 23 centers in 1879. Of the 202 candidates' papers in 7 subjects at these examinations, 151 passed. In 1890, out of 12,022 students at 219 centers, 6,667 took the examinations in 49 subjects and 3,507 passed. In 1900, out of 34,189 in 390 centers, 14,551 took the examinations in 64 technical subjects and 8,114 passed. The examinations are offered yearly in the following subjects. The first list shows the subjects where practical tests are required in the examinations; the second list those subjects wherein candidates for examination are required to present specimens of work, and the third list the remaining subjects.

The subjects in which practical tests are required are as follows:

Basket work.(a)
Bookbinding.(a)
Boot and shoe manufacture.
Bread making and flour confectionery.
Brickwork.
Carpentry and joinery.(a)
Electric lighting and power transmission.
Goldsmiths' work.(a)
Masonry.
Mine surveying.
Photography.(a)
Plumbers' work.
Typography.
Watch and clock making.

Following are the subjects in which specimens of work are required:

Basket work.(b)
Bookbinding.(b)
Cabinetmaking.
Carpentry and joinery.(b)
Cotton weaving.
Goldsmiths' work.(b)
Jute weaving.
Linen weaving.
Mechanical engineering.
Metal plate work.
Painters' and decorators' work.
Photography.(b)
Plasterers' work.
Rail-carriage building.
Road-carriage building.
Ship carpentry.
Ship joinery.
Silk weaving.
Silversmiths' work.
Wheelwrights' work and van and cart building.
Wool and worsted weaving and designing.

The remaining subjects are as follows:

Alkali manufacture.
Brewing.
Builders' quantities.
Calico and linen printing.
Coal-tar products.
Cotton and linen bleaching.
Cotton dyeing.
Cotton spinning.
Dressing of skins.
Electroplating and deposition.
Flax spinning.
Framework knitting and hosiery.
Gas manufacture.
Glass manufacture.
Hat manufacture.
Iron and steel manufacture.
Jute spinning.
Lace manufacture.
Leather tanning.
Lithography.

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[a] Specimens also required.

[b] Practical tests also required.

Milling (flour manufacture).
Oils and fats, including candle manufacture.
Painters' oils, colors, and varnishes.
Paper manufacture.
Pottery and porcelain.
Raising and preparation of ores.
Salt manufacture.
Silk dyeing.
Silk throwing and spinning.
Slate quarrying.
Soap manufacture.
Spirit manufacture.
Sugar manufacture.
Telegraphy and telephony.
Wool and worsted spinning.
Wool dyeing.

In the spring of 1900 the classes in which the largest number of students passed examinations were as follows:

CLASSES OF THE CITY AND GUILDS OF LONDON INSTITUTE IN WHICH THE LARGEST NUMBER OF STUDENTS PASSED EXAMINATIONS IN 1900.

Classes.	Students.	Classes.	Students.
Cotton spinning	689	Mine surveying	68
Carpentry and joinery	597	Cabinetmaking	68
Telegraphy and telephony	553	Wool and worsted spinning	66
Mechanical engineering	498	Rail-car building	64
Brickwork	484	Gas manufacture	64
Cotton weaving	474	Cotton and linen bleaching	63
Dressmaking	464	Photography	59
Plumbing	410	Bookbinding	54
Wool and worsted weaving	285	Wool dyeing	50
Masonry	273	Flour manufacture	45
Typography	270	Lithography	40
Electric lighting	183	Brewing	36
Boot and shoe manufacture	141	Plain needlework	34
Plain cooking	141	Goldsmiths' trade	33
Metal plate work	122	Linen weaving	30
Builders' quantities	121	Plasterers' work	29
Painting and decorating	119	Bread making	28
Millinery	113	Jute weaving	28
Cotton dyeing	73	Calico and linen printing	26
Raising and preparation of ore	72	Framework knitting and hosiery	26
Iron and steel manufacture	71	Jute spinning	23
Road-carriage building	71	Watch and clock making	20

The following schools had the largest number of students that passed the examinations:

Manchester Technical School	665
Regent Street Polytechnic	332
Technical School, Bolton	298
North Hampton Institute, London	227
Royal Technical Institute, Salford	180
West of Scotland Technical College, Glasgow	177
School of Science, Liverpool	176
Borough Polytechnic, London	173
Northern Polytechnic, London	169

The Institute publishes every year the examination questions of the previous spring, with comments of the examiners upon the results and with a syllabus of each one of the subjects to be covered by the next examination. This syllabus specifies the important subdivisions of the subject and gives references to a large number of the best books and articles in magazines and trade journals or reports bearing upon the subject. Classes may be registered by the Institute, no matter

where situated, if they have been taught by a teacher whose qualifications have been approved by the Institute and are under the direction of a proper committee, which must make certain statistical returns to the institution. If a teacher is without certain certificates of practical work and teaching, but is recommended by the local committee as possessing special qualifications, the Institute may approve the teacher. Students may take the examinations, although they have not been studying in a registered class, but the certificate is supposed to have more weight if it mentions the attendance upon such a class. The examinations are usually held between April 20 and July 10 at the local centers and at the same hour for all the country in a given subject. They are usually in the evening, from 7 to 10, although in some cases from 2.30 to 6.30, or even until 7.30 p. m. The annual report of the Institute gives a list of all the teachers that it has registered as meeting its approval in the various technical subjects.

The Technical Educational Board of the London County Council publishes a monthly journal, known as the London Technical Education Gazette, which gives valuable data about the London institutes. The number of evening classes of the more strictly technical and trade type conducted in connection with the board in the winter of 1900–1901 were:

Building trades	371
Art industries, including wood carving, chasing, engraving, etc	312
Mechanical engineering, telegraphy, telephony, electroplating, electric wiring and fitting, and other electrical industries	129
Lithography	76
House-furnishing trades	31
Boot and shoe and clothing trades	23
Carriage and van building	16
Leather tanning and dyeing trades	15

The total of the above and other technical trade classes is 1,246. The great majority of the above are in 11 polytechnic and technical institutes. The estimated expenditure of this technical education board in the year ending March 30, 1901, was £194,717 ($947,590), of which the technical schools and the technical departments of the polytechnics absorbed £85,500 ($416,086).

OBSTACLES OF TECHNICAL INSTRUCTION.

The devotion of the English to sports and the excitement occasioned by the Boer war have somewhat retarded interest in education and serious preparation for work in life. All English teachers deplore the lack of enthusiasm for education among all classes, and in technical education they regret that the theoretical classes dealing with the application of science to any special trade are not as popular as the practical workshop classes, although the success of the latter is closely associated with the knowledge of theory.

Class distinctions also are a serious drawback. There seems to be a great difficulty in mixing the wage-earners of the various occupations or the wage-earner and the clerk and foreman. Hence, in the technical classes care has to be taken lest the artisans imagine that they are being crowded out by a higher social stratum of so-called middle-class students. The hours of labor, while fewer in England than on the Continent, usually begin so early in the morning—that is, about 6, with an intermission for breakfast—that the apprentices and other younger workmen are too sleepy when the time for evening school arrives to give close application to the mathematical and some other branches. The attempt has been made in many places to get employers to let off the students of the evening school, if under 21, at an earlier hour, or let them begin work later in the day. This has been done in a few cases, but not to as large an extent throughout the country as is desired.

A serious obstacle to the progress of technical education is the indifference of employers. There is little marked opposition to the schools by the employers, and there are many large firms in every city that indorse the work heartily. Some give prizes for excellence in the technical classes, and also pay, in whole or in part, the fees of their workmen at the trade. Among the mass of employers, however, there is comparative indifference to the work of the institutes. If employers were more interested, it is thought that they might encourage a far larger attendance of their employees not only by shortening the daily time of work of their apprentices and other young men attending the institute, but also by advancing those more rapidly who could show, through attendance at the technical classes or otherwise, that they had especially fitted themselves for such advancement. Teachers of trade classes and the principals of the institutes are constantly asserting that there is more need of educating the employers than the men with regard to the advantages of technical instruction.

Another very serious obstacle—in fact, the most serious of all—is the poor general education of the English workman. Nearly all of the artisan class leave school at 12 or 13, and after earning small amounts in doing odd jobs about the streets or in factories, settle down at 15 or 16 as general laborers or factory operatives, or enter upon the learning of a trade. When they go to the evening technical classes at 15 or 16, they have forgotten much of what they knew upon leaving the elementary school. To bridge over this gap from 12 or 13 to 16 years of age is now the aim of all English educators. The trend of opinion seems to be in favor of extending the compulsory education from 12 to 14, as in Germany and in some other parts of the Continent. A further suggestion is to develop day continuation schools like our high schools, where as many as can possibly afford it can have a chance to continue their general education of a marked scientific and manual training

character till 16 years of age. Then the student could begin work at 14 to 16 in his chosen occupation, and be able to take advantage far better than now of the evening technical classes.

The following recommendations to the school subcommittee of the London building trades will serve to show the difficulties now confronting these schools, and the proposed methods of meeting them:

RECOMMENDATIONS.

Finally, we wish to make the following distinct recommendations:

1. That every effort be made to lengthen, with Parliamentary sanction, the present term of school life, including a raising of the legal age for leaving school, and that between 13 and 15 opportunity should be afforded for special instruction in manual training and drawing.

2. That no restriction whatever should be placed upon the persons attending theoretical classes in technical subjects apart from the general requirements that the members of the class should be capable of profiting by the instruction afforded.

3. That, with a view to enabling artisans to become qualified as general foremen, mechanics belonging to any branch of the building trades be permitted to attend both the theoretical and practical classes in other branches of the building trades.

4. That the learners under 19 years of age and improvers should be permitted to attend practical classes, provided that they show sufficient familiarity with the trade to render their efficient training possible without undue interference with the progress of the class.

5. That subcommittees should be appointed to visit and report upon the classes in each trade and discharge the other duties indicated in the report.

6. That, in the teaching of the purely trade classes (evening), and in the examinations connected with them, more stress should be laid on methods which secure mechanical skill and quickness of workmanship, as well as on theoretical knowledge, and students should not be encouraged to expend an undue amount of time and labor upon elaborate models of no practical use.

7. That, as far as possible, the teachers should be actually engaged in the trade in which instruction is given by them. In order to secure this, special classes should be instituted to qualify competent mechanics to be teachers, and for this purpose the polytechnics should be used as centers of normal training.

A further insight into the situation is gathered from the following conclusions arrived at by a letterpress and lithograph printing crafts conference of teachers, trade-union leaders, and employers from all over England, held in London January 25, 1901, which met to consider what changes should be made in the syllabus and examinations of the City and Guilds of London Institute, and in the general technical education of printers and allied crafts:

1. That no candidate over 18 years of age should be allowed to sit for the preliminary examination.

2. That the function of a technical institute is to teach that which can not be learned in the works, in addition to thoroughly teaching all underlying principles.

3. That there might be some slight reduction in the syllabus of the preliminary grade, so that young pupils might be intellectually capable of mastering the whole of it.

4. That "composing and machine" students should be taught a sufficient amount of each other's craft, where they overlap, particularly, to prevent one branch suffering from the want of knowledge of the other.

5. That employers, managers, overseers, and even the public should receive some amount of instruction, to give a clear idea as to what good printing is, and how it can be secured.

6. That employers, managers, overseers, and trade societies should throw more zeal into the necessary training of apprentices.

7. That apprentices should attend technical classes for a longer period than they now do.

8. That pupils should attend the preliminary class for two years, ordinary for two years, and the honors until they secure a first-class certificate.

9. That employers should hold out some inducement, as is done in the postal-telegraph department and the National Telephone Company, by an increase of wages to those who pass the examinations, or money prizes for each stage.

10. That pupils should attend a continuation school for two years (or up to 16 years of age), then one year for the preliminary, and two years each for the ordinary and honors grades.

11. That all firms should have a clause in the apprentices' indentures providing that the apprentices should make certain attendances at technical schools.

12. That, as before, no certificate be given for the preliminary grade.

13. That the London School Board be approached to provide classes in their continuation schools suitable for technical printing students and others.

14. That the instruction should be so broad and general in its scope as to allow for any employee becoming a master printer, and should aim at giving all the necessary information for such eventuality.

15. That greater care should be exercised in selecting apprentices.

16. That, having regard to the absolute necessity of sound elementary education to the future advancement of a printer in his trade, the compulsory school age should be raised to 14.

17. That it is undesirable that apprentices should be admitted to technical classes until they can satisfy the principal of the institute that their general education is such that they are able to benefit by the instruction.

18. That elementary principles and practice of drawing be included in the syllabus. That for lithographic printers and machine minders such drawing should be of a mechanical nature, in addition to the broad principles of art. For the compositor it should be expected that in a rough way he should be able to sketch out designs.

19. That a circular be sent to all county councils accentuating the importance of providing ample appliances for practical demonstration in the printing crafts.

20. That for practical tests all candidates should go to one center, where all will be under similar conditions.

21. That the practical tests should consist of some five or six examinations, upon different classes of work, conducted during the session.

22. That the aim of technical instruction should not be wholly for examinations, but should be to secure thorough practical education in the craft.

23. That machinery for class instruction might be hired for each session, and county councils might get it hired at a lower rate than by the institutes, such a matter being dealt with by each locality.

24. That an advisory committee be appointed to assist in revising the syllabus, in limiting the scope of the questions in the grades, in the appointment of examiners, and in other ways.

THE SELECTION OF TEACHERS.

Teachers of the workshop classes are found to require three qualifications: First, practical familiarity with the work taught, such as can best be acquired by holding a position as foreman in some first-class establishment; second, most of the scientific and art principles applicable to the work taught, and such as can be acquired in the best technical institutes; third, natural ability as teachers. In many cases it has been found very difficult to combine these qualities, but it is becoming less so with the age of the institutes. Some of the teachers in the evening classes continue to practice their trade by day. Where that is not done, special care must be exercised by the teacher to keep in touch with the latest progress of workshop practice. In some cases the experiment has been tried of having one teacher of the scientific principles of the trade and another of the workshop principles, but this was considered only a makeshift, and does not always work satisfactorily. Neither knows exactly how to fit his teaching to that of the other, and the students can much better be persuaded to take up the scientific lectures when they are given by the practical foreman who instructs them in the workshop.

BENEFITS OF TECHNICAL EDUCATION.

The benefits of this technical instruction are very largely brought out in other portions of this report. The student is benefited as a man by securing a better education. Where trade-union restrictions are strong, or where the apprenticeship system prevails, he may not earn full journeyman's wages until 21, no matter how competent he may be at an early age through natural ability or work in the technical classes, but after 21 he may advance rapidly to high industrial position, and in the large number of industries where these restrictions do not prevail the student will find his financial position improved through proficiency obtained in technical classes.

Aside from improvement of the workman, two other benefits are widely noted. One is the greater appreciation by the purchasing public of the good quality of goods and of the artistic side of house furnishing—mediæval castings, ornamental brickwork, enameling, etc.

The other advantage most widely noted is that of the trade itself. This may take the form of developing from the ranks of the workmen a superior class of foremen and of skilled workmen, or it may take the form of revealing and developing to untold usefulness the small minority, estimated by one distinguished principal as 3 per cent of his pupils, who are naturally observant, and who, under the training of these technical instructors, are likely to become the great inventors and masters of industries. Huxley is often quoted as saying: "It is worth spending a million to discover a Faraday." Mr. Bonnikson, inventor of a rotary escapement or karrusel lever, which has revolutionized the watch manufacture in England and even elsewhere, attributes much of his success to the training he obtained in the British Horological Institute.

The silk trade of Coventry is said to have been saved from decline by reason of instruction imparted to the sons of employers and workers in the trade.

Other evidences of the value of the schools are given in their proper place in this report, but the greatest evidence of all is their growing popularity, as shown by the number of pupils in attendance and the disposition of the business interests in control of English city governments to increase the expenditure for these institutions. England is learning much from American superiority in secondary education and in the magnitude of our advanced engineering schools, while America may learn much from the large beginning England has made in supplementing the fast-dying apprenticeship system by technical evening classes for artisans.

INDIVIDUAL SCHOOLS.

Detailed accounts of individual schools are set forth in the following pages. The schools of England are first considered, and afterwards those of Scotland and Ireland.

ENGLAND.

MUNICIPAL TECHNICAL SCHOOL, BIRMINGHAM.

This school was organized in 1891 and had as its basis the science classes of the Birmingham and Midland Institute which were taken over by the new school. The first session was held September 14, 1891. The governing committee of the school was instructed by the city council to establish a central technical school with both day and evening classes; to provide branch technical schools "in buildings adequately equipped for the purpose;" to appoint a principal to have charge of both day and evening schools; to arrange a scale of fees no higher than had formerly been charged in the institute, and to provide for free students—not to exceed one-fourth of those admitted, and to

arrange a course of study suited to the varied special requirements of students, but not to limit it to the requirements of the Government department of science and art.

In arranging the courses of study the design was to provide opportunity for men to learn the scientific laws which guide the operations on which they are engaged, and the properties of the materials they use, and thus enable the artisan to become a better workman, and at the same time a better man, through widening his mental vision. Accordingly a number of trade courses were arranged and the curriculum has been extended from time to time until its present scope has been reached. The teaching is required to be as practical and thorough as possible, and considerable time is therefore devoted to the laboratories and mechanical departments.

The day school was opened in September, 1897. Its object is to give boys, at the lowest possible fee, a general modern education, specially fitting them to take part in developing the industries of the town. The course of study is more scientific than that of the grammar schools, and the standard of instruction is more advanced than that of the higher grade board schools. Great prominence is given to scientific and workshop training, and general education is not neglected. Pupils who have passed through the day school are well fitted to engage in the local industries, and to rise to positions of responsibility. In most cases a youth should enter works at the age of 16, and continue his education at evening classes, such as are offered at the technical school. Boys may enter the day school at the age of 12, in which case the work of the first two years is of a preparatory character, and is regarded as a basis of future studies in science. It consists largely of training in exact methods of work in the laboratories, in the wood and iron workshops, in the drawing offices, and in following the studies connected therewith. After the first two years the boys are allowed gradually to specialize on those subjects which are likely to be of most use to them. The students in this school have the advantage of instruction not only by the full day school staff, but also by the specialists engaged to instruct the evening classes in technical subjects. The school is divided into three sections, the preparatory, the school of science, and the technical course. The three main divisions of the last course are mechanical engineering, electrical engineering, and applied chemistry.

The evening school, in which is found a very large proportion of all the students enrolled in the institution, was established for the purpose of carrying out the liberal scheme of technical education rendered possible by the technical instruction act of 1889. The endeavor of the committee was to provide practical instruction on broad lines, so as to make the school of the greatest possible service to all the local

trades. The school does not undertake to teach trades, recognizing that manual skill can come only from long practice in the shop; but it was also recognized that in order to give the most effective technical instruction the student must have opportunity of handling the tools, and learning the processes employed in his trade. The methods of instruction adopted are such as will meet these requirements, thus enabling the student to acquire a knowledge of the scientific principles on which local industries are based, and preparing him to take an intelligent interest in his daily work. The trade courses are two years in length, and are so graded that the student at the end of this time should have a good knowledge of the technique of his trade.

The curriculum of the evening school covers a wide field of instruction. Besides the trade courses previously mentioned there are a number of departments embracing a long list of scientific subjects. The chemical department is designed for those who wish to apply their knowledge to a business or trade in which chemical processes are carried on, for those who desire to become teachers of chemistry or analytical chemists, and for those who wish to obtain some insight into the science as a help in other subjects. There are elementary and advanced courses in inorganic chemistry, first and second stages in organic chemistry, special courses for chemists and druggists, senior courses in chemical philosophy and quantitative analysis, special work in chemistry covering crystallography and mineralogy, and chemistry for bakers. This last course is designed to furnish laboratory and practical work for bakers, and also to apply to students requiring a scientific knowledge of brewing.

METALLURGICAL DEPARTMENT.

The metallurgy department provides a four years' course for students who wish to make a special study of metals. For the benefit of those who only require a knowledge of certain metals, classes are arranged to suit trade requirements. For engineers and those engaged in hardware trades a special course is given in iron and steel. A course is arranged to give instruction in the metallurgy of copper, zinc, tin, nickel, brass, bronze, and German silver; and a similar course is devoted to gold and silver. There is an advanced course for classes who wish to study the nature of ores and other bodies in metallurgical processes. These courses cover the various subjects in such a general scientific manner as to prepare the students for a position of more than ordinary responsibility. In this department are also special courses in electro-plating and deposition, and an elementary course in metal coloring and bronzing, which provide ample instruction to enable the students to leave the school equipped for trades. Following are the metallurgical courses in full:

Electroplating and deposition.

Special course for electroplaters and gilders: Arrangement of plant in the workshop; preparation and testing of solutions; arrangement of apparatus for electro-deposition; use of ammeter and voltmeter; means of controlling current; preparation of work for electro-deposition; electro-deposition of copper, silver, and gold; stripping processes; finishing processes; recovery of silver and gold from old solutions; simple electrotyping processes.

Special course for brass workers and nickel platers: Arrangement of plant in the workshop; preparation and testing of solutions; arrangement of apparatus for electro-deposition; use of ammeter and voltmeter; means of controlling current; preparation of work for electro-deposition; electro-deposition of copper, brass, nickel, tin, and iron; stripping processes; finishing processes; simple electrotyping processes.

Advanced course: In addition to the subjects treated in the first year's course the following subjects are also taught: Theories of electrolysis, specific resistance, polarization of electrodes, thermochemistry in relation to electro-motive force, electrochemical equivalents, miscellaneous processes, deposition of zinc and alloys, deposition of cobalt, bright silver plating, galvanoplastic processes, recovery of tin from scrap tinned iron, grouping of cells, applications of Ohm's law, estimation of potassium cyanide, estimation of silver and gold in plating and gilding solutions, estimation of copper and of free sulphuric acid in the ordinary electrotyping solution.

The advanced class is divided into two sections—one for second-year students and the other for third-year students.

Metal coloring and bronzing.

Elementary and advanced courses: The metals in common use, their chemical and physical properties; the atmosphere, its composition, and the action of its constituents upon different metals; formation and properties of certain metallic oxides, chlorides, sulphides, carbonates, and acetates; classification and properties of the various reagents employed in chemical metal coloring; electro-metallurgy in relation to this subject; management of depositing solutions and correction of their defects; electrotype processes; electrochemical metal coloring; metallochromes; metals deposited by immersion; principles involved; effects of light; iridescent films and sensitive color compounds; metal coloring in relation to photography. Cleaning copper, brass, zinc, iron, etc.; bright and dead dipping, scratch brushing, polishing; coloring by dry and wet methods; producing various colors upon copper, brass, and other copper alloys; antique colors; deposition of arsenic, antimony, tin, and copper by immersion processes; deposition of copper upon brass by coloring, and subsequently heating the metal; preparation of acid coppering solution and deposition of copper upon brass; stopping off and parcel coppering; coloring parcel-coppered work; parcel bronzing; preparation of cyanide coppering and brassing solutions, and deposition of copper and brass upon iron, zinc, and other metals; mechanical metal coloring; use of varnishes, bronze powders, etc., including French bronzing processes.

The advanced class is divided into two sections—one for second-year students and the other for third-year students.

PHYSICAL DEPARTMENT.

The physical department is devoted largely to electricity in its varied applications. Two special courses in mathematics are provided as a foundation for the main subjects taught in this department. There is a course in theoretical mechanics and one in physics, embracing heat, geometrical optics, hydrostatics, sound, and general physics. The course in electricity covers the broad field of electrical engineering as it

applies to telegraphy, telephony, electric lighting and the distribution of power, and electrical jointing and fitting. Students taking the last subject are given such exercises in practical work as will qualify them for an electrical occupation. The course in detail is as follows:

Electrical jointing and fitting.

Stage I: Use and manipulation of tools; joints in copper strip and wire for overhead conductors; the various methods of jointing 7-strand cable, and jointing by means of "sleeves" or "couplings." Insulating joints. A lesson is given each evening on practical electrical work. All necessary material and a complete set of tools are provided for each student. Students are advised to attend classes in arithmetic and mensuration and the lectures on preliminary electrical engineering.

Stage II: Methods of jointing 19-strand conductors; lead-covered cables; twin cables; insulating joints; brazed joints. A lesson is given each evening on some subject connected with wiring, cable laying, care of electrical plant, etc. All necessary material and a complete set of tools are provided for each student. Students are advised to attend the classes in arithmetic and mensuration.

Stage III: Jointing concentric cables; joints in armored cables; vulcanized joints; jointing gutta-percha-covered wires. Lessons are given (so far as time allows) on various systems of overhead and underground distribution, the localization of faults, etc. Practical instruction is given in measuring "insulation." All necessary material and a complete set of tools are provided for each student. Students are advised to attend the classes in mathematics. The work in this class is of an advanced character, and intending students must either have taken the City and Guilds of London Institute certificate in the subject or obtain the sanction of the principal before joining.

ENGINEERING DEPARTMENT.

In the engineering department there are courses in practical geometry, mechanical drawing, machine construction and drawing, machine construction and design, applied mechanics, steam, mechanical engineering, graphical statics, structural design, hydraulic engineering, gas and oil engines, pattern making, and fitting and turning. All of these courses, except pattern making and fitting and turning, are designed for mechanical engineers and are not intended particularly for artisans except to allow them to acquire a better theoretical knowledge of their trades. The courses in pattern making and fitting and turning are designed to teach the technique and handiwork of trades. Following are the courses in detail:

Pattern making.

First division: This course comprises study of the various kinds of materials used in pattern making; the use of standard and contraction rules; tools, their names and uses; the setting and sharpening of various tools; marking and sawing; simple face and edge planing; edge shooting; boring with chisels and gouges; plain halving and dovetail halving; glued joints, plain and tongued; peg doweled and screwed joints; wood angling, plain and curved; the use of the turning lathe, and tools employed with it; simple wood turning; core prints, their various shapes and uses; round and square bosses and facings used on patterns; round and square core boxes; simple patterns (various); simple molding and founding.

A course of practical demonstrations of the methods of molding, core making, and casting in iron and steel is given in the molding shop during the session.

Students must attend regularly a class in mechanical drawing or machine construction.

Second division: In addition to the subjects taught in the first division, this course includes the nature and properties of various woods used in pattern making; the jointing, shrinkage, and warping of wood; the use of the circular saw; the centering, fixing, and chucking of patterns in lathe; the doweling of patterns and core boxes in halves; the making of circular work in segments; small wheels and pulleys; arm core boxes and sweeps for fly wheels; making cylinder patterns, pipe patterns, bends, etc.; loam boards for pipe and column cores; core templets for pipe flanges; core plates and strickles for bend pipe cores; simple odd-side molding; general molding and foundry work; loam molding.

A course of practical demonstrations of the methods of molding, core making, and casting in iron and steel is given in the molding shop during the session.

Students must attend regularly a class in mechanical drawing or machine construction.

Fitting and turning.

First and second divisions: Vise—Chipping and filing; use of square, calipers, rules, hexagonal and angle gauges. Lathe—Use of hand lathe, turning to templet and measurement; examples in simple screw cutting. Shaping machine—Shaping flat surfaces; gauge and angle work. Drilling machine—Drilling holes for clearance, tapping and templet, etc. Forging—Tools used in turning, planing, shaping, boring. Drills and chisels—Hardening and tempering. Instruction is given regarding the cutting tools used on various machines, forms of files, chisels, etc. Students are required to take both vise and lathe work, and must attend regularly a class in mechanical drawing or machine construction.

Third division: The course includes, in addition to the work stated in the first and second divisions: Vise—Samples of machine parts for fitting together, scraping and surfacing; setting out samples of work for planing, shaping, and drilling. Lathe—General turning and screw cutting; V thread, square and rifle pitches; boring and face-plate work. Planing machine—Preparation of test pieces; planing machine parts. Milling machine—Wheel cutting, square and hexagonal pieces. All work in this class will have to be done to standard and micrometer gauges. Practical instruction is given in the calculation of change wheels for screw cutting, forms of testing and test pieces, and other workshop details. Short lectures are given each evening on the use of various kinds of hand and machine cutting tools. A course of practical lessons on tool making and tempering is given in the smithy during the session. Students are required to take both vise and lathe work and must attend regularly a class in mechanical drawing or machine construction.

BUILDING TRADES CLASSES.

The building trades classes cover building construction, sanitary science, carpentry and joinery, masonry, and plumbing. Building construction covers drawing practice applicable to building in general, and the course in sanitary science consists in lectures on hygiene, infectious and zymotic diseases, water, air, sanitary plumbing, etc. The courses in carpentry and joinery, masonry, and plumbing are to equip students for advanced apprenticeship in these trades. Following are the building trades courses in detail:

Carpentry and joinery.

Preparatory course: Tools and their action in use; timber, different kinds and where obtained, simple exercises for use of various tools and simple joints; drawing of same to scale and isometric.

Students must regularly attend a drawing class in building construction.

Elementary course: In addition to more advanced detail of the preparatory syllabus, this course includes the nature and properties of the various kinds of wood used in carpentry and joinery and methods of seasoning timber; setting out working drawings, etc.; general knowledge of the construction of ledged, framed and braced, and framed and paneled doors, door frames and door jambs; ordinary sashes and frames. Joints in mortise and tenon, tusk tenon, fish tenon, scarfing, halving, simple dovetailing and notching, etc., and also joints in construction of various roof trusses, with drawings of same, etc.

Advanced course: In addition to the work on the elementary course, the advanced course consists of the following: Setting out working drawings in joinery work on boards; general knowledge of construction of half-glass doors with diminished stiles, with various kinds of panels, French casements, boxing shutters, circular sashes and frames and circular work generally; skylights and lanterns, bevels to same, and oblique work, finding bevels of hip rafters, jack rafters, purlins; splayed linings, etc.; intersection of moldings at different angles; method of strengthening beams and girders; principles required in framing roof trusses, partitions, bracing gates and doors, hinging and modes of applying them to obtain clearance, etc.; methods of throating, weathering, etc.; bending boards, gluing-up work, etc.; taking sizes and setting straight and geometrical stairs, hand railings, etc.

Senior course: Students who wish to try the honors examination in this subject are recommended to attend the advanced practical class, where special work is provided for them. They should also attend the drawing class in honors building construction and the course of lectures on the materials of engineering and processes of construction.

Masonry.

This course includes practical instruction in masonry, under the guidance of the instructor, and in addition each student is taught to draw to scale, set out and cut the molds, and prepare the various parts described in the following syllabus:

Nature and use of the various kinds of stone in building arches of brick and stone; methods of striking and jointing; definition of arches; raking and stretching moldings; columns, their proportion, entasis, twist, etc.; circular work, development of curves, ramp and twist; arches circular on plan; skew arches, niches, etc. Staircases, definition of steps, proportion of tread and rise, curtail step, spandrel step, spiral stair, stair with quarter space and winders, development of winders, etc. Mold cutting, copying drawing, etc.; proportions of cement, lime, sand, ashes, gravel, etc., in concrete and mortar for various purposes. Practical exercise in setting out and working the more intricate problems.

A special feature is instruction in working to scale.

Students taking this course are also advised to attend a class in practical geometry.

Plumbing.

Elementary courses: Workshop practice—Marking off and cutting out sheet lead; simple exercises in lead bossing; bending pipes up to 2 inches in diameter.

Lecture class—Simple geometrical problems as applied to plumbing, with reference to roof work; simple mensuration; solders and soldering, their composition, preparation, and uses; fluxes, their action and uses; special advantages of lead burning; workshop appliances, etc.; construction and action of valves used in plumbing; ventilation of pipes; principle and construction of various traps, their uses and relative advantages; tools used in plumbing, their forms and uses; fitting up a workshop; varieties of pipes used in plumbing; capacities of pipes of various sizes.

The classes in geometry for sheet-metal workers and plumbers and the lectures in sanitary science are specially adapted to students in these classes.

Advanced courses: Workshop practice—The properties of lead and tin, white and red lead, cements, etc.; solders and soldering; autogenous soldering or lead burning; fluxes, etc.; tools employed by plumbers; cutting out sheet lead; setting out work from working drawings; roofing; drainage, external work; varieties of traps; soil pipes; ventilation; drains; water supply for houses; cisterns, cocks, and valves; brass work used by plumbers; water-closets, their fittings and supply; baths, lavatories, and urinals, their service, traps, and wastes; hot water and steam circulation; meters, valves, reflectors, etc.

Lectures—The lectures deal with the following subjects: Geometry as applied to plumbing; mensuration; properties of lead and tin, white and red lead, oxides, and cement; autogenous soldering, solders, and ordinary soldering; drainage; roof work; water supply; soil, vent, and waste pipes, their arrangement and construction; principles and construction of hot-water supply; principles and action of siphon; principles and action of hydraulic ram; pump work; sanitary arrangements in houses and buildings; brass work used by plumbers.

METAL TRADES CLASSES.

There are metal trades courses in brass founding, gas fitting, and sheet-metal work; and there are courses in typography and farriery. The metal trades classes are as follows:

Brass founding.

Workshop practice: The course in brass work consists of molding, casting, modeling, reversing in lead and wax, filing, turning, hammering, screwing, casting, hard and soft soldering, pattern making, saw piercing, construction of blocks to produce bends and scrolls, chasing, dipping, and burnishing, filing including surface dressing (such as scrolls), with filing of flat and rounded surfaces to drawings; physical and chemical properties of iron, steel, brass, and other alloys; turning with hand tools to pattern or drawing, the students making their own turning tools, drills, etc.; screwing with chaser; making metal and wood chucks; molding and casting, including making the odd side; use of the oval turning chucks; hammered work in brass and copper; hardening and tempering steel springs used in the brass-foundry trades. Those students who are sufficiently advanced are allowed to make their own patterns, core bearings, and core stocks. The course also includes hard and soft soldering; use of the hammer, rule, compass, gauge, and circular saw; finishing processes.

Lectures: The lectures deal with the principles involved in the work, and the properties of the metals and alloys used.

False coring.

The course consists of practical instruction in the making of cores from the molds without core stocks, the drying of the molds, the placing of patterns in the molds, pouring processes, etc. Students are taught the special nature of the sand needed for various kinds of work.

Gas fitting.

The workshop course includes practical instruction in jointing lead and compo pipes, in meter fixing, and in the use of the pressure gauge. The theoretical work includes the making of full-sized working drawings of meter connections necessary for fixing meters in various positions, and in making both full-size and reduced sections of various fittings and pressure gauges.

Sheet-metal work.

The course in sheet-metal work consists of cutting patterns on geometrical lines from tin plate, sheet iron, zinc, brass, or copper, and testing their accuracy as to size and shape by making up models; various methods of jointing sheet metal by soldering, grooving, riveting, double seaming (or knocking up), and dovetailing, etc.; planishing, wheeling, hollowing, setting, stretching, and wiring; explaining the use of the press, stamp, lathe, wheeling, and other machines and tools used for the manufacturing of sheet-metal goods; the physical and chemical properties of iron, tin, lead, zinc, copper, brass, galvanized iron, and tin plate; the manufacturing or refining of the same; solders and their fluxes; fuels, their composition and mode of application.

Short lectures are given each evening, of a practical and scientific character, upon matters useful to sheet-metal workers. The classes in geometry for sheet-metal workers are arranged for students in connection with these classes.

There is a comprehensive lecture course in typography, and those taking it receive instruction in the use of the linotype machine. Lectures on farriery are provided for shoeing smiths who may wish to become informed in the principles of their work.

Besides this long list of subjects for boys and men there are women's classes in cookery and dressmaking in both the day and evening schools. The day-school courses give general elementary instruction in these subjects, such as is required by the ordinary housekeeper. The evening courses are more extensive and thorough. The cooking course covers plain cooking and the dressmaking course fits its students to earn a living at that trade.

The conditions of entry to the day school are as follows:

No pupil will be admitted from another school unless he can produce a satisfactory certificate of conduct from his former head master. To enter the school of science a boy must have a good knowledge of English composition, geography, history, and arithmetic, including decimals. For admission to the preparatory course a somewhat lower standard is accepted. No boy is admitted unless he lives with his parents, guardian, or near relations, except with the special permission of the school committee. Boys are admitted at the age of 12 and upward, but may not commence a new session's work after reaching the age of 16. The school fee is £3 ($14.60) per annum, and the student must provide his own books and stationery. There are twelve entrance scholarships offered annually for competition among the pupils in the Birmingham elementary schools. Six of these scholarships give free admission to the school for four years and provide a grant for maintenance of £5 ($24.33) for the second year and £10 ($48.67) each for the third and fourth years. The committee awards two scholarships annually which entitle the holders to free admission and maintenance to the amount of £5 ($24.33) per year during the term of the scholarship. Besides these the Priestly scholarship is

awarded every two years to the candidate under 20 years of age who stands highest in the prescribed examination.

The management of the school is under a technical school committee of 16 members, besides the lord mayor. The teaching staff consists of 1 principal for the entire institution; for the day school, 1 head master, 8 assistant masters, 3 workshop instructors, and 2 assistants; for the evening school there are 4 heads of departments, 36 lecturers, 17 demonstrators, 11 workshop instructors, and 9 assistants, making in all 92 members of the teaching staff. Besides this there is a secretarial staff of 6 members, and an establishment staff of 13 members.

The attendance varies according to the season of the year, being greatest in the fall and least toward spring. The average attendance in October, 1899, was 3,739, while in February following it had fallen to 2,520. For the corresponding months of the previous year the attendance was 3,869 and 2,880, respectively. The 2,520 students of February, 1900, were distributed among the departments as follows: Chemical, 305; metallurgical, 294; physical, 497; engineering, 684; building trades, 282; metal trades, 132; miscellaneous, 160; women's classes, 166.

The building is constructed of pressed brick, with terra-cotta trimmings. The main wings reach a height of eight stories. It was erected at a contract price of £47,489 ($231,105). During the first few years of the school it occupied temporary quarters, and the new building was not occupied until 1895. The equipment of apparatus, machinery, etc., is first-class in all respects, and cost, approximately, £12,000 ($58,398). The annual cost of maintenance, including small additions to apparatus, for the fiscal year ending March 31, 1900, was £18,411 ($89,597). Of this amount, £8,013 ($38,995) was for salaries and wages and the remainder for interest, sinking-fund account, and general incidental expenses. The income of the school for the same period was slightly more than £20,000 ($97,330). Public funds contributed the greater portion of this income, nearly £18,000 ($87,597) being derived from such sources. The city of Birmingham was the chief contributor.

The Brass Workers' Union pays part of the fees of many of their members or apprentices; the Gun Makers' Union does the same thing, although there is not yet any special training provided for their craft, and the master bakers pay half the fees of many pupils.

Students go from the school into shops as apprentices, but they command higher wages and earn promotion more rapidly than those who have not had school advantages. Employers prefer the school-trained apprentices, and in one instance a prominent manufacturer of high-speed engines allows his apprentices to go to their work one hour later than usual if they attend the evening school. The schools have led to improvement in shop training.

The work of the school has been satisfactory. The attendance upon the day school, which was not opened until 1897, is not as large as is desired. It is the opinion of some connected with the school that large results can not be expected from the day school unless more money is spent upon it. It is suggested that the city can not easily raise sufficient money to teach trades to day scholars, and that to do this each trade should raise its own money for this purpose. The evening school is open three evenings a week to those who work during the day, and a large number of workmen avail themselves of this opportunity. Rather more than half of these are under 21 years of age.

MUNICIPAL TECHNICAL SCHOOL, BLACKBURN.

This school was founded in 1887, by subscription. In 1889 it became a public institution, in part, and in 1891, at the completion of the Jubilee Memorial Building it became wholly public. It was designed to give instruction in general science and art, and technical and trade instruction in textiles, building, and electricity. Its main object is to develop theoretical knowledge and practical skill among the artisans employed in the industries of this immediate community.

Pupils in the night school must work during the day along the lines of their study. Admission is by examination, and these examinations are arranged to suit the requirements of the applicant.

The courses of instruction are divided into departments and these are subdivided into subjects. A number of the subjects are literary or scientific, and are not here referred to except as they are required for a basis in technical work. The departments of instruction are art, physics, chemistry, building trades, engineering, textiles, manual training, and one for commercial and domestic subjects.

In the art department instruction is given in fine or applied art. During the first year students devote their time to elementary work in free-hand, model, and geometrical drawing, and to the theory of perspective, light, shade, and color. In the second year the work in decorative and textile design is the same, but in the third year students begin to specialize according to the course they intend to complete. Third, fourth, and fifth year students in decorative design take up the various phases of the art, with a view to some definite purpose. Students desiring to do so can pursue their studies through the sixth year or longer. These advanced students do practical work in design and clay modeling, and also give much time to study from life and to painting.

In the study of textile design the free-hand copies used at the beginning are patterns of actual fabrics, so that ideas of design and taste are formed while the student is learning the use of pencil and charcoal. Next, he takes brush and color exercises, and is encouraged to attempt original work. The third year includes actual work in fabrics in the

weaving department. In the fourth year the student is advised to enter the weaving department and take the regular course there. When he can produce a good design he is encouraged to take up advanced subjects. In the weaving school he is afforded every facility for the reproduction of his designs, so that his instruction is practical and complete.

The instruction in wood carving is designed primarily to be of service in local industries. It begins with the necessary drawing exercises, and continues through the higher theoretical grades and practical shopwork. The embroidery class has for its object, first, to assist in the development of taste and good workmanship, by the use only of the best designs obtainable and by teaching the technique of high-class needlework; and, second, to afford students of design a means of seeing their working drawings applied to the actual materials for which the designs were made. The object of the instruction in this class is to make the articles produced both artistic and useful.

In the physics department electrical technology occupies a prominent place. The courses in this subject are arranged for those who are engaged in or are preparing to enter electrical trades, and for those who desire a better acquaintance with this branch of engineering on account of the important part it plays in other trades. The work begins in elementary magnetism and electricity and advances through the various branches of electrical study until the course in electrical engineering is complete. The theoretical work is comprehensive, and there is sufficient practical work to equip the student to take up his selected line of work.

The instruction in building-trades subjects covers building construction, brickwork, masonry, and carpentry and joinery. The foundation for all these subjects is geometry and graphic statics. The syllabus of examinations indicates that much time is given to the theory and technique of the subjects. Every phase of each subject is taken up and thoroughly discussed, after which each student is subjected to a rigid examination.

The textile department provides thorough courses in practical weaving, cotton spinning, and textile chemistry. The weaving course embraces ordinary and advanced theory, practical cloth construction and analysis, and practical weaving, besides textile design. The theoretical course covers the general principles of fabric structure, twilling, spotting, color, warping, sizing, warping and sizing machinery, the loom in all its parts, principles of tappet structure, dobbies (their use and construction), picking mechanism, pick and pick arrangements, the Jacquard machine and its use, classification of fabrics, damasks, double cloths, tapestries, gauze, and many other subjects relating to the production of cloths. There is an additional course of lectures on the details of construction of various kinds of plain and fancy cloths

and the use of design paper. In this course the student is supplied with pieces of the various kinds of cloth discussed and is required to analyze them. During these theoretical studies and lectures the student is assigned to practical work in the weaving shed two evenings a week, and is there afforded an opportunity to acquire an intimate knowledge of branches of work and classes of machinery other than he is able to get in his daily employment. The weaving shed is liberally equipped with both hand and power looms in great variety, and the student can exercise his skill in producing all kinds of cotton cloths, from plain weaves to Jacquard lenos and tapestries, brocades, and pile. He makes and executes his own designs, and is thoroughly trained in all that is necessary to make him a successful weaver.

The complete course in spinning is designed to cover three years. In the first year are taken up the geographical position of the cotton fields, the cultivation, harvesting, and preparation of cotton for the market, the physical properties of cotton, the objects of mixing, and the principles of cleaning and carding cotton, and the construction and operation of cleaning and carding machinery. The second year is devoted to the construction and operation of drawing machines and the principle of drawing slivers; the construction and operation of combing machines; the construction and action of roving machines in all their variety, and accessory appliances; the essential features of good yarn; the construction and action of the mules and the methods of driving them, together with the effect of each operation on the material; the construction and operation of ring-flyer spinning frames, and the bobbins used; and calculations of speed, draft, twist, etc., in connection with all the above-mentioned machines. The third year's or honors course can not begin until the student has a certificate in the first and second year courses. This year is devoted to character and quantity of waste produced and its utilization, the preparation of waste for spinning, what machinery is necessary, and the character of yarns produced; the production of doubled yarns for various purposes; testing yarns for strength, elasticity, twist, and moisture; the selection of raw cotton and its manipulation by various machines, noting defects in machines and remedying them; the construction and planning of spinning and doubling mills; selection of machinery; schemes of drafts and speeds, lighting, heating, ventilation, and protection against fire; arrangement of power and its transmission to machinery; and cost of production, wages, insurance, and other charges. From the above it will be seen that the instruction offered in this department prepares the student to enter upon advanced work in the mill.

The course in textile chemistry is arranged so that third-year students in the textile department may have the opportunity of becoming acquainted with the scientific principles underlying the textile

industry. It is also suitable for weaving managers and overseers. The course of instruction covers the composition of air with reference to humidity and carbonic acid; water composition with reference to boiler-feed waters, boiler scale, and antiincrustators; bleaching agents, disinfectants, and antiseptics; acids and alkalis, and the commoner metals, such as iron, zinc, copper, tin, etc.; the microscopic appearance of fibers, and the action of common reagents upon fibers; the classification of sizing substances; properties of glycerin, fats, oils, waxes, soap, starch, sugar, gluten, dextrin, etc.; cotton dyeing, and mordants and theories of dyeing.

In response to a request from the Blackburn Master Painters' Association, a course in practical painting has been arranged for apprentices who may desire advanced instruction in work belonging to their trade. This work has been conducted through one session only, but has been found to be very useful. Many apprentices made great progress in their work, and it is believed the usefulness of this instruction will increase. A class in theoretical and practical photography is provided for and it is expected to begin work at the session of 1901–02.

The teaching staff consists of 21 instructors. The attendance in the day school is about 55, and of these 10 are in the weaving class; the attendance of the evening school is 1,800 in all grades, of which 300 are engaged in practical shopwork, 100 are electrical students, and 200 are in the weaving classes.

The school has been the means of increasing the intelligence and efficiency of the working classes generally, and general benefits have come to local industries.

The attitude of trade unions toward the school is very friendly. Eleven years ago the management explained the work of the school to the unions, and disarmed criticism by refusing to admit pupils to the practical classes except those working in the same line. Four unions now give nearly 100 scholarships, varying in annual value from 10s. to £1 ($2.43 to $4.87).

Employers prefer school-trained apprentices, and as an evidence of their high appreciation of the work done in the school several employers pay half the fees of students from their shops. A few firms paid for a time all the fees of students who went from their establishments, but this liberality tended to produce a rush of ignorant boys into the school, and the principal now requires all to pay half fees, and later, if the pupil is deserving, the half fee is returned.

The school has led to improvement in shop training, and its work has been entirely satisfactory in every way. It does not attempt to turn out finished workmen, but aids the apprentice to attain the highest perfection in his trade.

TECHNICAL SCHOOL, BOLTON.

The idea of a technical school in this borough was conceived in 1887, being part of the scheme adopted for commemorating the Queen's Jubilee. The Mechanics' Institute offered their building—a gift equivalent to £5,000 ($24,333); the subscriptions received amounted to £6,000 ($29,199); and a grant of £1,000 ($4,867) was obtained from the borough corporation. It was not until 1891, however, that the school was started, and not until 1892 that the well equipped building in Maudsley street was opened. It was thought that this building would serve the town for many years, but it was not long before more spacious premises had to be sought. The attendance has increased in the evening school from 338 at the first session, beginning in 1891, to 2,400 at the eighth session, ending in 1900.

The rules and regulations provide that persons shall not enter any of the classes unless they have sufficient preliminary knowledge to profit thereby. No class is continued unless twelve or more students enter during the first month of the session. No student is admitted to a class in technology unless for at least one of the qualifying science or art subjects adapted thereto. Students admitted to classes in practical work in the evening school must be employed in the same line during the day. The fees in the evening school range from 5s. to 10s. ($1.22 to $2.43) per year, and in the day school the fees range from 6 to 12 guineas ($30.66 to $61.32) per year.

The courses of instruction are arranged primarily to meet the needs of the community, and as cotton manufacture occupies the most prominent place in the industrial life of the town, subjects pertaining to it have prominence in the school. Other industries are not neglected, however, and thorough instruction is provided along many practical lines.

In the technical day school the subjects of instruction covered are: Theory of cotton spinning, cotton spinning machine work, and spinning calculations; theory of weaving, fabric structure, designing of fabrics, drawing design, cloth analysis, weaving-machine work, and weaving-machine calculations; mechanical engineering, practical mathematics, practical work at vise and with chief engineering machine tools, sketching, coloring and machine designing, wood and metal turning, engineering model drawing, and engineering geometry. These subjects are distributed under the three general divisions of cotton spinning, weaving and designing, and practical engineering. Besides the above-mentioned subjects there is also a department in the day school devoted to manual instruction in wood, metal, and wood turning, which is carried on in conjunction with the elementary and higher grade schools of the town. The purpose of the course is to give boys a thorough training in the application of drawing and in the use of tools.

The evening school courses cover more comprehensively all the subjects mentioned under the day school and a large number of other subjects. Students in the practical classes of the evening school are required to work in shop or factory during the day along the lines of their studies in school. The courses in cotton spinning, weaving, and designing, and cotton dyeing, bleaching, and printing are very thorough. The details of these courses are as follows:

COTTON SPINNING.

Preliminary stage: The preliminary class in cotton spinning is held on Tuesday evening during the session, and is designed to give such students as desire it a brief general training in the rudiments of cotton spinning prior to taking the usual City Guilds' courses. The lessons include very brief notes on cottons and on all the machines and processes of cotton spinning, and also simple calculations.

First-year course: Geographical position of the world's cotton fields, with suitable soils and climates; planting and picking of cottons; the chemical, physical, and commercial properties of cotton fibers; special features of Sea Islands, Egyptian, Brazilian, Peruvian, American, Indian, and other cottons; seed cotton; use of ginning; foot-roller gin; churka gin; bow gin; saw gin; Macarthy and knife-roller gins; defects in cottons; various notes on cotton; mixing of cotton; bale breakers; mixing lattices; hopper feed arrangements; objects of opening; single openers; cages and fan draft; double openers; exhaust feed and delivery trunks to openers and scutchers; calculations; objects of scutching; single and double scutchers; piano-fed regulator; improvements in regulators; two and three blade beaters; construction and setting of beater grate bars; cage bars; lap end of scutcher; suitable speeds; productions; various notes; calculations; objects of carding; different kinds of cards; action of parts common to all cards; coiler motion; Wellman card; roller and clearer card; undercasings; revolving flat card; cover plates; various methods of setting flats; stripping and grinding; clothing and setting a card; calculations; various notes.

Second-year lectures: Silver lap machine; ribbon lap machine. Comber—General action of parts; duties of machine; nipper and top comb mechanism; timing and setting; detaching mechanism; various details; calculations. Drawing frame—Duties of machine; general action of parts; coiler and roller mechanism; stop motions; various details; calculations. Bobbin and fly frames—Uses of machine; general description; swing; spindles and rollers; building motion; how winding is done; bobbin and flyer leading; differential motions; calculations; various details. Self-actor mule—Motions and processes connected with drawing-out; arrestation of parts; twist motions; backing-off and faller locking; drawing-up and faller unlocking; quadrant; nosing motions; copping motion; fine-spinning motions; various details; calculations. Ring spinning—General description; rollers; spindles; winding-on; mule versus ring spinning. Flyer throstle.

Honors lectures: Selection and blending of cottons; testing and commerce of cottons; methods of main driving; doubling; the twiner mule; ring and flyer throstle doubling; doubling and winding; calculations; reeling; bundling; gassing; thread making; practical manipulation of scutchers, cards, combers, and draw frames, bobbin and fly frames, mules, and ring frames; mill buildings; arrangement and proportions of machinery for coarse counts, medium counts, and fine counts; waste made at each process; spinning and fancy yarns; cost of production; wages; other calculations; roller covering; lighting; heating; ventilating; humidifying; insurance; testing, uses, and commerce of cotton yarns; various notes; calculations.

Ordinary grade, second year: This course comprises a lecture course on weaving mechanism and courses of lessons on textile calculations, fabric structure and analysis, and designing. The lecture course on weaving mechanism considers the following

subjects: Construction and fixing of negative and positive acting shedding tappets; shedding by means of oscillating tappets; dobby shedding; also negative and positive acting dobbies; the Blackburn dobby; the Keighley dobby; the Burnley dobby; the Knowles or American dobby; Jacquard shedding, single-acting machines; also double-acting one-cylinder machines; double-acting two-cylinder machines; motions to stop the loom when a wrong card is presented; Jacquards of special construction, open-shed and cross-border machines; devices for increasing the scope of a machine, thereby effecting a saving of cards, the Bannister or double-scale harness, the compound pressure harness for damask weaving; damask or twilling machines, the Bessbrook Jacquard; also Tshörner and Wein's Jacquard; building and dressing a Jacquard harness; common arrangements of tie ups for Jacquard harnesses; card-cutting, lacing, and wiring; card-repeating machinery; essential features of lappet and swivel looms; picking motions, lever pick, Yates's pick, swivel pick, carpet pick, scroll pick, Jackson's pick, pick-and-pick motions; motion to impart two beats of the slay for one revolution of the crank shaft; also terry-pile motion; letting-off motions; also taking-up motions of a special character, Pickles's motion; Whittaker's motion; continuous-acting motions; box-motions for check looms, Diggle's chain, Wright Shaw's motion; Cowburn and Peck's motion; Whitesmith's principle as exemplified in Hacking & Co.'s motion; Hodgson's motion; the Knowles motion; circular-box motion; center weft-stop motions; various makes of loom temples and their suitability for different fabrics; devices of a special character, as the Northrop device for automatically renewing weft without changing shuttles or stopping the loom; Ross's device for automatically changing shuttles without stopping the loom; the Seaton device for inserting picks without carrying a cop or bobbin through the shed.

The course of lessons on textile calculations is in detail as follows: Calculations relating to speeds of tappets; calculations relating to taking-up motions of a special character, Pickles's motion; Whittaker's motion; continuous-acting motions; methods of dropping or casting out hooks of a Jacquard machine when it is required to use the mounting for a coarser reed than that for which it was built; to find average counts of yarn when several counts are used in the same fabric; to find average price per pound of yarn in a cloth composed of various colors or counts of yarn; to find weight and cost of material of each color in a striped fabric; to find weight and cost of material of each count of yarn in a striped fabric made from various counts of warp; to find weight and cost of material in a piece of cloth with crammed stripes; to find weight and cost of material in a piece of cloth figured with an extra warp; to find weight and cost of material of each color in a checked fabric; to find weight and cost of material in a piece of terry cloth; estimation of wages for winding; warping; beaming; sizing; drawing-in; twisting and weaving; from given data, to find total cost of production throughout of a colored checked fabric.

The course of lessons on fabric structure and analysis, and designing, considers the following subjects: Principles of fabric structure embodied in the following types, namely, brocade, damask gauze or leno, velveteen, Bedford cord; corduroy, terry, lappet, and swivel fabrics; practical analysis of these; designing for small-figured effects to be woven by means of tappets, dobbies, and Jacquards; designing for fancy leno effects to be woven by means of tappets and dobbies; analysis of more difficult examples of lenos; designing and coloring for stripes and checks suitable for shirtings, skirtings, and dress materials; practical analysis of these; designing for striped effects for bedticks, awnings, and window blinds; employment of extra warp to form stripes, and of extra warp and weft to form spots, checks, and all-over patterns; practical analysis of these; backed cloths, their construction; items to be considered before preparing a sketch for a Jacquard design; also, method of transferring it to design paper.

Overlookers' class: This class is restricted to men actually engaged as managers, overlookers, carders, fully qualified outfitters, and first-class honors students. There are no examinations in connection with this class, and any students wishing to sit at

the examinations of the City and Guilds must attend the usual classes. The lessons are made to suit the special requirements of the class members, and consist of calculations, lectures, cotton and yarn testing, and practical work.

WEAVING AND DESIGNING.

Ordinary grade, first year's course: This course comprises instruction in the preparation of yarn for the loom and in weaving mechanism, a course of lessons on textile calculations, and a course of lessons on fabric structure and analysis and designing. The following subjects are treated under preparation of yarn for the loom and weaving mechanism: The different forms in which yarn is received by the manufacturer and its subsequent treatment for gray and colored goods; winding frames for warp yarn, cop winding, and drum winding frames, winding frames for weft yarn, pirn-cop winding frame to wind weft upon bobbins; machine to wind yarn from ball warps on to pirn bobbins; quick-traverse pirn winding frames to wind weft upon bare spindles; also winding upon pirn bobbins by means of conical bowls and beveled disks. Warping and warping machinery: Mill warping, chain warping, beam warping, sectional warping; the theory and purpose of sizing yarn; ingredients employed in the manufacture of "size" and their object; manufacture of "size," mixing, fermentation, and boiling of ingredients; application of "size" to yarn by means of "dresser" sizing, "ball" sizing, "slasher" sizing, and "hank" sizing; also comparative merits of each system; description of "slasher" sizing frame; methods of beaming or winding-on; relative advantages of dyeing yarn in the cop, hank, and warp; also of dyeing raw cotton and sliver; hand-loom shedding by means of long and short lams; principal parts and motions of an ordinary power loom, their object, and the mechanical principle governing each; shedding by means of under and side tappets; under and over roller motions to act in conjunction with tappets, to convert the negative action of the latter into a positive one; picking, cone or Blackburn picking motion; beating-up motion; methods of controlling the delivery of warp in the loom; taking up motion. Automatic stop motions: Weft work, loose reed, and stop rod; loom brakes; temples; setting and timing the parts and motions to act in unison.

The course of lessons in textile calculations comprises the following subjects: Bases of the systems employed to indicate the counts of cotton, silk, worsted, woolen, and linen yarns; the tables of weights and measures employed when ascertaining the counts of yarn; also various methods of ascertaining the counts of short lengths of yarn; to ascertain the counts of folded yarn produced by twisting together two or more threads of the same, or of different counts; from given data, to find length, weight, and counts of yarn; to ascertain the quantity of material to produce a cloth according to specification; to ascertain counts of warp and weft to produce a cloth of required weight per yard, or piece of known dimensions; various systems of naming reeds as adopted in the principal manufacturing districts; calculations relating to heald knitting; also casting out when using a set of healds for a coarser reed than that for which they were knitted; calculations relating to marking motion of slasher-sizing frame; calculations relating to driving of tappets; calculations relating to taking-up motion; to ascertain the speeds of looms and sizes of pulleys to give required speeds; wage calculations for various operations.

The course in fabric structure and analysis and designing treats of the following subjects: The structure of fabrics and methods of distinguishing warp yarn and weft yarn; use of design paper and method of indicating designs upon it; the plain, or calico weave, and its derivatives, as ribs and simple dice effects; practical analysis of these; twill weaves and their derivatives, as fancy regular twills and patterns developed by combining either ends or picks, from two or more twills, in some definite order; practical analysis of these; construction of satin weaves; development of simple weaves on a satin basis; wave and diamond effects; also patterns based upon

the diamond, as honeycomb, Brighton, and other simple weaves; practical analysis of these; huck-a-back canvas, mock lenos, sponge cloth, fancy dice patterns, and diapers; practical analysis of these; analysis of more difficult samples; development of color effects in the plain and other simple weaves by means of colored threads of warp and weft.

Honors grade, third-year course: This grade comprises three sections, namely: (1) General Section, (2) Section A, and (3) Section B. A separate examination is held and certificates awarded in both Section A and Section B, which may be competed for in either the same year or in separate years. All students must, however, present themselves for examination in the General Section, as well as in either Section A or Section B, otherwise no certificate is awarded. Section A is devoted to the study of the principles of ornament and the theory of color, especially as regards their application to textile decorative design. Section B is devoted to the study of subjects pertaining to mill management.

The General Section comprises the following lecture course: Characteristics of the principal textile fibers and threads; also methods of distinguishing them; characteristics of yarn spun on the throstle frame, ring frame, and mule; also, the influence of twist upon yarn; treatment of cotton yarn whereby it is made to resemble silk, e. g., polishing and mercerizing (students have an opportunity of examining actual fibers and threads under the microscope); calculations relating to diameters of threads and their practical application to fabric structure; to ascertain threads per inch required to maintain a cloth of similar character when altering the weave; to ascertain counts of yarn required to maintain a cloth of similar character when altering threads per inch; to ascertain counts of yarn and threads per inch required to maintain a cloth of similar character when altering the weight; data affecting the selection of picks per inch, counts of warp, and weft, and weave, suitable for fabrics for specific purposes; also the characteristics of warp and weft yarn most suitable for various classes of fabrics; common defects in fabrics caused by faulty preparation of the warp, faulty construction, and unequal balancing of warp and weft; structure and analysis of—also designing and card cutting for—and methods of gaiting looms to weave the following types of fabrics, namely: Alhambra and honeycomb quilting; also piqués or toilet welts; matelasses for cotton vesting; toilet quilting with two picks to a card, three picks to a card, four picks to a card—(1) loose back and (2) half-fast or stocking back—five picks to a card, fast back; improved Mitcheline, otherwise known as patent satin quilting; Kidderminster or Scotch carpet; tapestries with one warp and two wefts, two warps and one weft, two warps and two wefts, two warps and three wefts; figured terry-pile fabrics with three picks to a card, five picks to a card; plain and figured velvets and plushes; pile carpets—tapestry, Brussels, and Wilton; figured leno brocade; combination lappet and gauze figuring; swivel and gauze; also combination pile and brocade figuring; construction of Jacquard lifting cams; Bolton and district standard list of prices for weaving toilet, honeycomb, Alhambra, and tapestry quilts; uniform list, also Radcliffe and district list of prices for weaving; calculations involved in determining the departmental and total cost of producing a piece of cloth when values of material and labor are given.

Section A comprises a course in textile decorative design and may be taken by second-year students also. The examinations for this section are both written and practical. Each candidate is required to prepare at least two original designs occupying not less than 192 ends and 168 picks, and to weave a specimen of cloth embodying either of the two designs. The designs and woven specimens must be vouched for as being the candidate's own work. The course of study comprises a course of lectures on decorative art principles of both form and color and the preparation of sketches and designs for Jacquard looms. These are illustrated by a set of lithographic reproductions of fabrics in the South Kensington Museum; also by the Grammar of Ornament, by Owen Jones, and by many other works of art; and also by a large collection of textile fabrics and diagrams.

The lecture course treats of the following subjects: The function of ornament and the various means by which textile fabrics are decorated; the principles of ornament as deduced from natural forms, and examples of good ornament; classes of ornament, namely: mnemonic, symbolic, and aesthetic; styles of ornament, namely, realistic or natural, conventional or abstracted, and naturalistic. The use of animal figures in textile ornament. The study of plant forms; also their utility and application in textile ornament; characteristic of growth in plant forms; stem and branch junctions, leaves, and flowers; construction of useful elementary geometric forms; various bases or plannings for an all-over design, and the faults to be chiefly guarded against; methods of preparing sketches for Jacquard designs; color—its purpose; also its value for decorative purposes; light—the source of color (demonstrated); transient or ethereal color as exemplified in the rainbow and in other spectra; also material or pigment color, as paint; classes of colors—primaries, and their combination to produce secondaries and tertiaries; theory of harmony and contrast of color according to M. Chevreul; attributes of colors; application of color to textiles, and the modification it undergoes according to the nature of fiber and character of fabric to which it is applied; character and style of ornament and coloring most suitable for various fabrics; characteristic features of form and coloring as exemplified in the more notable historic styles of textile ornament.

The course in sketching and designing Jacquard patterns is devoted to the practical application of the knowledge obtained from the preceding lectures and will include the preparation of sketches and their execution into designs suitable for various types of fabrics as enumerated in the syllabus of the General Section. Also honors students intending to sit for examination in Section A will prepare their sketches and designs under the supervision of the teacher.

Section B furnishes a lecture course on mill management, as follows: Comparative merits of various systems of preparing warps for gray, colored, and mixed goods; selection of machinery plant for manufacturing goods in which cotton predominates; also the relative capacity of each machine; the most desirable situation for a weaving mill, as regards soil, winds, climate, and also proximity to a market town; most important considerations to be observed in planning a weaving mill; arrangement of various departments with regard to economical working and oversight; natural and artificial lighting; comparative merits of coal gas, acetylene gas, and electricity for weaving sheds; ventilation, humidification, heating, and sanitation of a weaving mill; insurance of buildings, plant, and stock; common causes of mill fires and precautions to adopt in order to prevent their origin and spread; fire appliances—both hand and automatic; transmission of motive power by means of toothed wheels, belts, and ropes; looms driven by electricity; speed of main shafting, size of pulleys, and most suitable speed for various kinds of looms; the construction and most important features relating to the manufacture of the following specialties, namely: Two separate and distinct cloths woven one above the other at the same time and in the same loom; cloth woven double width; pillowslips woven without seam; hose piping; lamp wick, flat and circular; cotton and other woven belting for driving; ribbons, tapes, trousers suspenders, skirt belting (straight and shaped), and ladder tape for Venetian blinds.

There is a practical weaving course for second and third year students which all students who enter for section A are advised to take. This course comprises pirn winding, drum winding, mill warping, Yorkshire dressing or beaming, and drawing-in; designing; card cutting and lacing; weaving on handlooms with treadles, dobbies, and Jacquard machines; also on power looms with tappets, various types of dobbies, single and double acting Jacquard machines, rising and falling shuttle-box motions, and circular or revolving shuttle-box motions. These looms are principally equipped for the production of such fabrics as best represent the types of Bolton and district manufactures, and are therefore of special value to those engaged in, or

desirous of acquiring a knowledge of, their manufacture. Each student receives samples of cloth woven, with full particulars of their manufacture.

COTTON DYEING, BLEACHING, AND PRINTING.

The course in cotton dyeing is as follows:

Cotton and other vegetable fibers: Origin; physical structure; chemical composition; action of chemical agents, etc.; general characters of flax, jute, hemp, and China grass fibers. Processes preliminary to dyeing: Boiling, bleaching (yarn cloth), methods, and machinery employed. Water: Impurities and their influence; methods of detection, correction, and purification. Mordants: Theories of dyeing; rôle of mordants in general; pigments and coloring principles. The natural coloring matters: Indigo, logwood, brazilwood, peachwood, old fustic, Persian berries, quercitron bark, cetechu, tannin matters; their origin, general characters, methods of application, coloring principles, commercial preparations, etc. The mineral coloring matters: Methods of dyeing chrome yellow, iron buff, manganese brown, Prussian blue. The special treatment required in the dyeing and finishing of yarn and cloth made from cotton, linen, jute, or other vegetable fibers; calculation of the cost of dyeing. Methods of making dyeing experiments.

The course in bleaching comprises the following subjects:

Vegetable fibers: Cotton, linen, China grass, etc.; origin and mode of separating the fibers from the plants; retting; physical and chemical structure and properties; action of chemical agents upon the fibers; detection of the different fibers; their natural impurities, and such as are contracted during spinning and weaving. Theory of bleaching: Mode of using, and action of the various agents employed in bleaching, e. g., acids, alkalies, lime, hypochlorites, rosin, soap, antichlores, etc. Theory of bleaching; chemicals used in bleaching and finishing; method of ascertaining their commercial value, detecting impurities, etc. Machinery, construction and use of: Singeing and shearing machines; high and low pressure boiling pots or "kiers;" Mather's steamer kier; limeing, scouring, chemicking, and washing machines; rubbing boards; squeezers, hydro-extractors; scutchers and openers; drying machines; water, starch, and dry mangles; back-starching machines; stentering machines; stretching and damping machines; calendars, beetling machines, etc. Water, with special reference to bleaching and finishing: Mode of determining the presence of impurities by chemical analysis or otherwise; methods of purification by mechanical and chemical means; purification of waste liquors. Practical operations: Full details of the processes employed in the bleaching and finishing of cotton yarn, thread, and cops; calico (market bleach, Turkey-red bleach, madder bleach); muslins, lace curtains, etc.; linen yarn, thread, and cloth. New processes and machinery proposed for or adopted in bleaching and finishing.

The course in cotton printing includes vegetable fibers; bleaching of cotton and linen cloth; general theories of dyeing; mordants; coloring matter—natural coloring matter, artificial coloring matter; color mixing; styles of printing; water, with special reference to bleaching and printing; practical operations of the dyeing, printing, finishing, and other departments; mechanism of printing—hand or block printing—its defects and advantages; fastness of colors—actions of acids, alkalies, oxidizing and reducing agents, soap solution at various temperatures, light, etc., upon dyed and printed colors; mode of making experiments in color mixing, dyeing, printing, etc.

The courses in electrical and mechanical engineering cover the usual subjects taught in such courses.

The course in plumbing and sanitary engineering embraces thorough instruction in the technology of the trade and the necessary practical shopwork.

There is a course in carpentry and joinery, covering broadly the theory of the trade. In the preliminary grade the simpler principles of the trade are taken up and the student is led gradually into the more difficult problems of the ordinary grade. This latter grade takes up properties of different kinds of building woods, the uses of tools, applied mechanical drawings, the proportions of the parts of a house, moldings, bevels, stairs, joints, hinges, trussings, casements, and skylights, also plumbing and slating. These studies in theory are supplemented with shop practice covering twenty exercises designed to develop skilled workmen.

A course in building construction covers the technology of brickwork, masonry, carpentry, founders and smiths' work, slating, joinery, and plumbers' work. After this are studied the nature, characteristics, quality, and defects of the materials in general use by builders; the strength of materials—resistance to tension and compression, safe working stress, limit of elasticity, dead and live loads, stresses in simple frames, etc.; scaffolding, appliances for hoisting blocks and falls, derrick, etc., and general construction details, such as excavations and foundations, drains and sewers, the various kinds of walls, flues, and chimney shafts, floors and roofs (iron, concrete, and wood), preparations for plastering and plumbing, inside furnishings and finishings, and general specifications of labor and materials required in the various branches of the building trade. Those taking this course are admitted to the practical courses in painters' and decorators' work and wood turning.

The course in wood carving is intended to benefit apprentices and others engaged in architectural decoration, cabinetmaking, patternmaking, joinery, coach building, and wheelwright work. The instruction covers the suitableness of different kinds of woods for various purposes; the different kinds of tools, how to keep them in order, and methods of using them, and thorough practical work.

The school offers instruction in typography, covering quite fully the prime essentials of the printer's art. The course covers tools and appliances, sizes and relations of types, general principles of composition, hand and linotype composition, news, job, and book work, ornament and display, hand, platen, and machine presses; roller composition, sizes and qualities of paper, estimates, printers' accounts, and general office management. All information given is thoroughly practical in character, and students are passed upon an examination in practical tests.

There are other courses for men and boys which appear to be rather too advanced to apply to strictly trade or technical callings. Among these are theoretical, experimental, and applied mechanics; magnetism and electricity; chemistry; mining and mine surveying; theoretical and practical metallurgy, and steam and steam engines. This last course,

while technical in great degree, seems to go beyond the requirements of ordinary steam engineers.

The school provides a course of cookery lectures and demonstrations, but it seems to be designed rather to assist housewives than to prepare women to take up cooking as a means of earning a living.

In addition to the various industrial courses there has recently been added a commercial course. The object of the instruction in this course is to train men to handle and dispose of the manufactured products of the town. The school is taking the broad position that the people of a community not only should be able to produce articles of trade in the most skillful and economical manner, but should be educated in the science and practical applications of commerce so as to place those articles in successful competition with those produced in other communities.

The school is controlled by a technical instruction committee, consisting of the mayor and 26 other members, of whom 15 are councilmen.

The total registration in the evening school for the year ending in 1900 was 2,400. Of this number 938 were in the technological department, 168 took practical work in spinning, and 199 took theoretical courses in the same line. The registration in the day school was 200.

Labor unions have always been friendly. Both engineering instructors are unionists. The vice chairman of the technical committee is a prominent officer of the trade council, and there are also on the committee representatives of the spinners and of the cooperative society. The cooperative society has an arrangement by which it pays half of the fees of those whose average attendance is at least 80 per cent. About 1,000 students attend under this arrangement.

Employers prefer school-trained workmen, and a number of firms pay tuition for those of their apprentices who can pass the entrance examination, and give them books and instruments. The results of this action have been highly gratifying, and some 400 or 500 youths are now enjoying the advantages of these scholarships.

It is possible for former pupils to enter upon some trades without serving an apprenticeship, but the management does not consider it wise for apprentices to obtain all their training in the school. Fully 90 per cent of the evening school students are apprentices in shops and factories.

BRADFORD MUNICIPAL TECHNICAL COLLEGE, BRADFORD.

In March, 1878, this school was opened with nearly 400 students. The urgent demand for a suitable building led the mayor to call a meeting of those interested, and the result of this meeting was subscriptions to the amount of £11,000 ($53,532), which was soon increased to £17,000 ($82,731). The new building, which, with its equipment, cost nearly £40,000 ($194,660), was opened in 1882. Subsequent additions swelled this amount to £50,000 ($243,325). The question of

maintenance was at first a serious and important consideration, the deficits from 1883 to 1887 amounting to nearly £9,000 ($43,799), but these were cleared off by local subscriptions to the jubilee fund.

It was not until 1890 that the college received any substantial aid from public funds. The urgent need of further assistance raised the question of the desirability of transferring the management, and in 1899 the college became vested in the corporation of the city.

A new scheme of management was adopted and is proving the wisdom of its projectors. As defined by this scheme, "the general object of the foundation shall be the maintenance of a technical college under the technical instruction acts for persons above 14 years of age, subject to the provision that no secondary day school or school of science shall be carried on in the college, but that day and evening classes may be held in the subjects of art, and of manual, scientific, or technical instruction connected with the trades and manufactures of Bradford and the neighborhood, to which none shall be admitted under the age of 15 years except on the recommendation of the governing body of the school in which they have been taught, and in no case under the age of 14 years; also in advanced commercial subjects at day and evening classes, to which none shall be admitted under the age of 16 years."

The work of the college is divided into four departments, textile industries, chemistry and dyeing, engineering, and applied art.

In the textile industries department the idea that a satisfactory knowledge of the subjects taught can be obtained in evening classes has been abandoned, and the regular course of instruction is now given in the day school only. There are evening classes for specialized advanced work, designed for those already engaged in textile trades, and there are free elementary evening classes conducted in the board schools (elementary public schools) under the joint supervision of the technical school committee, the Bradford school board, and the head of the textile department of the college. These elementary classes are an essential part of the work of the college, and the students are taken to the college twice during each term (six times a year), that they may have the benefit of special lectures.

The full regular course of instruction includes the consideration of the following subjects:

Textile course: Nature and properties of raw materials, such as wool, cotton, silk, jute, and miscellaneous fibers; the various stages of preparation of these materials, from carding and combing to twisting, along with the practical use of the necessary machinery; the building of cloths, with abundant practical exercises in experimental weaving on hand and power looms designed to produce fancy dress fabrics, linings, mantle cloths, coatings, shawls, rugs, and every description of woven fabrics; structural and color ornamentation, including practical application of color theories, color and weave effects, color blending, the selection of color ranges, simple spot and swivel coloring, and the coloring of elaborate figures for tapestries, plushes, brocades,

etc.; designing for plain, fancy, and figured textiles, including classification of woven textures, development of figures by means of weave, methods of utilizing extra weft or warp for additional weight or figuring or both in combination, the various types of intricate figured textiles, and the preparation of these various designs for the loom; pattern analysis and calculations; embroideries and embroidery machines, embracing designing, ordinary embroidery and lace work, and the necessary practical work on machines, and a course of lectures in dyeing.

The special evening classes for those already engaged in textile trades cover advanced instruction in dress goods designing and coloring; advanced figure designing; worsted coating, designing and coloring; pattern analysis and calculations; advanced cloth construction and testing; experimental and advanced weaving; practical loom tuning; textile mechanics, and preparing, combing, and spinning.

The fees and charges for materials for the full regular course amount to £3 10s. ($17.63) per term the first year and £3 15s. ($18.25) per term for the second and third years. The fees for the special advanced courses range from 7s. 6d. to £2 2s. ($1.83 to $10.22) for the course.

The department is equipped with every mechanical appliance necessary to enable students to have the same practical advantages that they would have in a factory.

The general course of instruction in the chemistry and dyeing department extends over three years. The first year is devoted largely to chemical laboratory work and experimental dyeing, no less than 20½ hours out of 35½ being devoted to these subjects. The remaining 15 hours are given to physics, mechanics, mathematics, and lectures. The second year covers practically the same subjects in the same manner, with the addition of structure of yarns and fabrics. The third year takes up color matching, chemical philosophy, fuels, microscopy and crystallography, but most of the time (28 hours per week out of 35) is spent in the chemical laboratory or dyehouse. A portion of the dyehouse work is done in the dyehouses of firms in the city. The various subjects are treated very thoroughly. The dyeing lectures cover the origin, character, and methods of bleaching the chief varieties of cotton, linen, wool, silk, and other fibers; water suitable for dyeing and methods of testing and connecting natural waters; the origin, varieties, and coloring principles of such natural coloring matter as logwood, brazilwood, camwood, madder, cochineal, lacdye, orchil, safflower, quercitron, Persian berries, fustic, etc., and their application to different fibers, the shades produced by different mordants, stability of colors, etc., indigo dyeing in all its phases; the origin of coal-tar dyes; classification and chemistry of dyes; and the application and fastness of dyes. As has been suggested, great stress is laid on practical dyehouse work. No detail of practical work is omitted or neglected.

The evening school provides special short courses in advanced work for those who can not take, or do not need to take, the full regular day course.

The department is equipped with a dyehouse fitted up with modern machinery and implements, and an equipment of finishing machinery.

The fees for the general course are £13 ($63.26) per year.

The work of the engineering department is divided into four sections, namely, (1) civil engineering, (2) mechanical engineering, (3) electrical engineering, and (4) building trades and architecture, the last named being in conjunction with the art department. The department is supplied with suitable mechanical appliances for practical manual instruction in each section. The strictly engineering courses cover the usual ground in such courses in both theoretical and practical shopwork. The course in building construction seems to be designed for practical builders and not for mere mechanics. General shop practice is provided in pattern-making, turning, and fitting and erecting, but this practice appears to be limited to the needs of the various engineering courses. There is a theory and practice course in photography, but it is not claimed that it prepares students to engage in the photograph business as a means of making a living. A plumbing course is provided for apprentices and young journeymen, which embraces the theory and practice of the trade in a very thorough manner. The full course prepares the student for examination for the certificate of the Worshipful Company of Plumbers. The principles and practice of horseshoeing are taught by a course of 10 lectures and 10 demonstrations in practice.

The applied art department includes a system of instruction which is intended primarily to train students in becoming more expert in the artistic side of the industries of the city. There are courses and lectures in design, painting, architecture, modeling, and drawing. The chief difficulty in the way of this kind of education has been the inability of those who need it most to pay for it. The college overcomes this by providing a scheme of free classes, catering to painters, decorators, and wood carvers. These classes are open to apprentices and intending apprentices. The first year the students work all day at the college; the second year they work half the day at the college and half the day in a shop as apprentices to a master, and they are paid on the same basis as if they worked full time with the master. After the second year students are expected to attend evening classes during their apprenticeship. The wood-carving class differs from the above in that the students are apprenticed to the college. When sufficiently advanced they assist the head master-carver and are paid for their work. The term of apprenticeship is four years, but it is expected that students will remain two years longer.

The college teaching staff consists of 40 instructors. Many of them have been workers at the trade they now teach, but as good lecturers are difficult to find among such men the heads of departments are not all practical workers, though they have a thorough knowledge of the subjects taught.

In 1900 there were 800 evening pupils in textiles, dyeing, engineering, and building, and 200 in general culture. There were 200 day students in the technological department from 14 to 18 years old taking the three years' course either in dyeing, weaving, engineering, or applied art. In the year 1898–99 there was an enrollment of 1,317.

The college occupies a handsome and commodious building, well equipped and adapted to its purpose.

The staple industry of Bradford is textiles. A depression in this industry led to the establishment of the school, and good judges state that there has since been created a wider range and a higher order of products. Manufacturers declare that these beneficial results are largely due to the college. Employers are so eager to get students that it is difficult to keep third-year men in the school. These students soon rise to responsible positions at good paying wages. They begin work as apprentices, but their superior training makes them more valuable than mere shop-trained apprentices.

So successful and satisfactory have been the efforts of the management that another £50,000 ($243,325) building is necessary and will be built at once.

The income of the college for the year 1898 was £8,302 ($40,402). Of this amount the Bradford and West Riding county councils supplied £3,333 ($16,220) and the science and art department £1,838 ($8,945); students' fees amounted to £1,552 ($7,553), and the remainder came principally from donations and subscriptions.

MERCHANT VENTURERS' TECHNICAL COLLEGE, BRISTOL.

The object of this school is to provide complete preparation for an industrial career. Both day and evening classes are conducted. The day classes consist of a boys' school and college day classes.

The boys' school admits boys not under 9 years of age to its lower classes. These classes are designed to give preliminary training as an essential basis for the more advanced courses of study in the upper forms of the school, and they include the common school branches and French, drawing, simple designing, and elementary science. Advancing from these lower grades, the pupils take up either the commercial course of the Bristol School of Commerce or a course in applied science preparatory to becoming skilled artisans, chemists, electricians, engineers, architects, contractors, medical men, etc., or to entering the royal navy or the merchant service. The instruction continues on the foundation laid in the lower classes, and also includes manual training in carpentry and forge work. German is taken up and French continued.

The college day classes are open to both boys and girls over 15 years of age. These classes provide courses in mathematics, civil and mechanical engineering, electrical engineering and applied physics, building construction, chemistry and metallurgy, sanitary engineering,

navigation, and University of London courses, besides courses covering all compulsory subjects in civil-service examination for clerks of the second division. These courses appear to be very comprehensive and practical; but only the course in navigation, a carpenters' course in the department of building construction, and a plumbers' course in the department of sanitary engineering, come within the scope of this inquiry. These latter courses are somewhat less practical than similar courses in the evening classes. The course in navigation prepares mariners for board of trade certificates as mate and master in the home trade; second mate, first mate, ordinary and extra master in the foreign trade, and second or chief engineer.

The Bristol School of Commerce constitutes the commercial department of the college and offers thorough courses in the usual commercial subjects, including shorthand.

The evening classes provide special courses in applied science, commercial courses similar to those of the commercial day classes, University of London matriculation classes, and technological courses in a number of trade subjects.

Technological students are urged to attend the college classes in those science subjects which relate to their trades. The technical or trade courses are systematically arranged to cover a sufficient period to make them thorough and complete, and to encourage students to take these systematic courses in their entirety. Fees for an entire course are fixed at a lower rate than the combined fees for the separate portions of the same. The composition fee is 2s. 6d. (61 cents) per session.

Technological examinations are conducted by the City and Guilds of London Institute, and all students are expected to enter for these examinations. The fees for the examinations are paid by the governors.

The evening technical courses comprise the following subjects: Bookbinding, boot and shoe manufacture, bread making, brickwork, carpentry and joinery, dressmaking, electric lighting and power distribution, practical electro-technics, electric-light wiring, masonry, mechanical engineering, metal-plate work, millinery, painters' and decorators' work, pattern making, plasterers' work, plumbers' work, road-carriage building, telegraphy and telephony, typography, and wood carving. Of the detailed courses, some corresponding to similar courses described in connection with other schools are here omitted. The following are given in full:

Bread making: Ordinary grade—Chemistry and heat as applied to baking; chemical composition of wheat and flour; composition and properties of fat, starch, dextrin, glucose, maltose, and albuminous matters of wheat; action of moisture, heat, and albuminoids on starch; fermentation; the microscope, as applied to the examination of flour and yeast; practical bakehouse work; making patent yeast and Scotch flour barm; preparation of ferments, sponging and doughing; scaling, molding, and

proving of loaves; cleaning, firing, manipulating, and firing of oven; changes produced during baking; cooling and storing of bread; bakehouse utensils. Honors grade—Flour—Leading characteristics; relative merits; flour testing and valuation; detection of adulteration; bakehouse testing routine; constituents of flour; constitution of starch, saccharification, and fermentation; composition of gluten; diastases. Yeasts—Detection of adulteration; determination of gas-evolving power; patent yeasts; ferments and leavens. Various bread-making methods—Quantities, times, and temperatures; special breads and bread-making processes; fancy breads; aerating bread. Bread-making machinery—Steam, gas, and oil engines, how to start, work, and keep in order. Baking—Ovens. Practical bakehouse management—The bakery, its ventilation, drainage, and sanitary arrangements, etc., factory acts in their relation to bakers.

Candidates for honors are required to present themselves for a practical examination on flour testing.

Brickwork: Bricks; excavations; laying drainpipes; lime; cement; sand; mortar; concrete; foundations; damp courses; air bricks; dry areas; bond in brickwork; stone facing; hollow walls; fireplaces, coppers, and ovens; chimney shafts; arches; paving; pointing; black mortar, etc.; tiling; measuring brickwork, tiling, paving, concrete, etc.

Candidates who have passed the written examination in brickwork may present themselves for a practical examination in that subject. Candidates who pass the practical examination receive a special certificate to that effect.

The practical examination includes the following work: (1) Bricklaying—(*a*) Setting out work from architectural drawings. (*b*) Building and properly finishing, either with struck, or raked and pointed joint, as desired, any given piece of work. (2) Brickcutting—(*a*) Setting out work in detail from architectural drawings, and obtaining the templates, molds, etc. (*b*) Cutting and finishing any required piece of gauged work from templates and molds supplied.

Dressmaking: Instruction is given in the theory and practice of dressmaking in preparation for the examinations of the City and Guilds of London Institute. The six classes are limited in number and students are expected to attend regularly and to sit for examinations. The advanced class is restricted to students who have already attended a dressmaking class in this college, or who possess sufficient elementary knowledge of the subject. The courses include lectures on drafting patterns, and cutting out, making, and fitting dresses; also on materials, linings, quantities, cost, modes of fastening, uses of whalebone, various stitches used in dressmaking, etc. Each student is required to make up a body to fit herself properly, and to do such other work as the teachers may require.

Electric lighting and power distribution: Preliminary course—General notions concerning current, resistance, and E. M. F.; primary and secondary batteries; principles of magneto machines, dynamos, and alternators; the induction coil; principles of direct-current motors; electro-magnets; electric bells; systems of house wiring; methods of jointing; materials used in installation work; wiring tubes; calculation of drop in mains, etc. Ordinary grade—Development of magneto-mechanical, E. M. F.; alternators; magnetic induction; hysteresis; calculation of windings for field magnets, transformers, etc.; self-inductance; tractive power of magnets; choking coils; shunt, series, and compound wound dynamos; differential winding; drum and ring armature windings; direct-current motors; electric traction; efficiency of motors; starting switches; commercial instruments for measuring current; E. M. F., resistance, and power; the Ruhmkorff coil; transformers; lightning guards; secondary batteries; arc and incandescent lamps, etc.

Students attending the ordinary grade course ought to have passed in the elementary stage of the board of education's examination in magnetism and electricity; or they should show that they have a sufficient knowledge of this subject. To obtain

satisfactory results from the study of electro-technology, it is of the greatest advantage to possess a sound knowledge of the underlying principles of mathematics, electricity and magnetism, and machine construction and drawing.

Honors grade—This course is taken under one of the three heads, namely: (*a*) Electric instruments, etc.; (*b*) dynamos, and arc and incandescent lamps; (*c*) electrical power distribution.

The work includes: The predetermination of characteristics; the theory of alternating current generators, motors, and transformers; polyphase generators, motors and transformers; power transmission; the measurement of alternating currents, voltages, and power, etc.

In order to attend the honors course, students must have previously passed in the ordinary grade examination of the City and Guilds of London Institute. A fair knowledge of plane trigonometry is also necessary to follow parts of this course.

The dynamo and testing room is open one evening in the week, when students have opportunities to experiment with the college dynamos, transformers, etc.

Electric-light wiring class: Toward the end of the session a practical class is held for instruction in jointing electric-bell wires, house-lighting leads, and cables. No student is permitted to join this class unless he comes under one of the following heads: (1) Students who have made at least sixteen attendances at a class in magnetism and electricity, or in electrical engineering, held in this college during the earlier portion of the same session; (2) students specially recommended by the professor of electrical engineering.

Millinery: Instruction in this subject is in preparation for the examination of the City and Guilds of London Institute. The examination is practical and written, and is so arranged as to test the candidate's skill in millinery as well as her knowledge of the nature of the materials commonly worn. To obtain a certificate, candidates are required to pass in each of the parts 1, 2, and 3.

1. Practical examination: Each candidate is required to cut out, put together, and line a hat or bonnet or covered shape from a given measurement and copied from a given model. The candidate may also be required to make a straw shape, to make up bows, to execute an order from given instructions, and to do such other work connected with millinery as may be indicated at the time of the examination. The material required will be supplied by the institute.

2. The written examination: This includes questions on the following subjects: Parts of a hat or bonnet; how put together and how finished off; materials used for shape making; preparing the shape; covering shapes; quantity of material required for a hat or bonnet and cost when completed; stitches used in millinery; drawing a diagram of a plain hat; millinery trimmings and how they should be utilized; measurements for headgear and mode of fitting shapes; methods of renovating materials and cleaning straw and felt; making and trimming of hats to match costumes, and estimates of cost; methods of teaching millinery.

3. Specimen work: Each candidate is required in the six months preceding the examination to prepare the work described in the programme of the City and Guilds of London Institute.

Painters' and decorators' work: Ordinary grade—Tools and brushes, etc.; pigments, oils, and varnishes; painting; distemper; paper hanging; gilding; bronzing; writing; graining and marbling; staining; decorating.

Honors grade—The preceding subjects carried further, and also stippling, badgering, scumbling, glazing, and stenciling; sign writing; hanging ceiling paper, friezes, borders, dados, Anaglypta, Lincrusta, Cordelova, etc.

Telegraphy and telephony: Ordinary grade—The fundamental principles of electricity, units of measurements, galvanometers, shunts, resistance coils, condensers, the electrical testing room; detection and removal of faults; telegraph and telephone

lines, submarine cables; systems of telegraphy and telephony, faults, earth currents and electric disturbances; testing materials, etc.

Honors grade: Telephony—Transmitters and receivers; reduction coils; telephone and telegraph instruments worked simultaneously; distance limits; metallic loop system; call bells; exchange systems; switches; automatic call boxes; Hughes's induction balance.

Typography: Ordinary grade—The examination consists of a paper of questions, and of a practical examination for compositors, held in a printing office. Candidates who are compositors, must pass in both parts of the examination to obtain a certificate. The written examination is divided into two parts for (*a*) compositors, and (*b*) pressmen or machine managers. Candidates, according to their occupation, may select their questions from Sections I and II, or from Sections I and III. The sections showing courses of instruction are as follows:

I. General: Papers; the damping down of paper; counting; packing and keeping stock; the harmony of colors; sizes of jobs; folding, stitching, stabbing, and sewing.

II. Composing: Lays of Greek, Hebrew, and German cases; casting up value of composition; margin; title-pages; notes, appendixes and indexes; mechanical quoins; paging; the point system of type bodies; working in companionships; type music; type founding.

Classification of job work; color work; display work; curves and circles; rule bending and twisting; ornament in display; borders; printing in colors.

III. Press and machine work: Hand-press, platen, and single-cylinder machines; making register; use of points; rollers; inks; underlaying and overlaying; woodcuts and process blocks; stereotype plates; mounting blocks; printing with bronzes and leaf metals; the causes of slurring. The practical examination consists mainly of composition from manuscript or printed copy supplied to the candidate.

Honors grade—The examination includes more difficult questions on the subjects required for the ordinary grade, and also on perfecting and rotary printing machines; it includes stereotyping, electrotyping, process blocks, accounts necessary for printers, etc.

Wood carving: The course of instruction meets the requirements of carvers and apprentices desiring to obtain a better knowledge of their craft, and more particularly meets the needs of architectural and cabinet carvers. Amateurs who wish to gain a knowledge of carving are admitted to the class.

Besides these full courses there are provided special courses in nearly all the subjects to meet the individual needs of those who for any reason do not desire a full course.

There are two college buildings, erected and equipped at a cost of over £55,000. The departments are liberally furnished with the latest appliances for teaching the various subjects, and the laboratories and workshops are fitted with modern apparatus, machinery, and tools.

The number of former students who are employed by prominent firms throughout the Kingdom shows the popularity of the work done in the college.

MUNICIPAL TECHNICAL INSTITUTE AND SCHOOL OF ART, COVENTRY

The origin of the technical education movement in this community was distinctly voluntary in character. In 1883, a substantial amount was subscribed for a capital fund and maintenance for five years.

Numerous difficulties arose, and among the most troublesome was that of procuring a site. In March, 1887, this was relieved by the donation of a site with the buildings thereon, and in 1894 the school was opened. The buildings, while not imposing in appearance, cover a block in area and are well adapted to the requirements of the school.

This school aims to teach science mainly in its application to trades and industries. It provides instruction and shop practice for apprentices, journeymen, and foremen, and brings to their knowledge newly-discovered processes and methods for the purpose of improving any special trade or of introducing new branches of industry.

All departments are open to students of either sex not under fifteen years of age. Members of the institute are of two classes, student members and club members. The latter belong to societies or clubs permitted to hold their meetings at the institute and pay an annual fee of 2s. (49 cents) to the funds of the institute. Student members are such as pay class fees. Pupils need not work in the same line during the day, but preference is given to such and to sons of citizens. All must take theoretical as well as practical work, attending two and one-half hours twice a week for two years.

The courses of instruction include horology, textiles, trades and handicrafts, commercial and domestic subjects, and practical science courses.

Horological department: Complete instruction is given in the scientific principles of horology and all that relates to the making of a keyless watch movement, with full adjustment for compensation, isochronism, and position; practical work in the use of modern measuring instruments; use of tools; turning, filing, etc.; gauges; train pivoting and planting, escapement making, handing, examining, springing, tinning, and the practical making of tools and gauges. The year's work is divided into three terms of ten weeks each. The first term is designed for junior apprentices, the second for senior apprentices, and the third is still more advanced. Besides the regular course there is one in advanced theory designed to prepare students for the city guilds' honors grade. This class meets only in alternate sessions, the other session being given to the class in electricity as applied to horology. There are also special classes in the application of the Breguet spring and escapement making, and also one in practical electricity as applied to horology, and instrument and gauge making. In all the practical work sound workmanship is insisted upon.

Textile school: This course covers three years and includes the preparation and manufacture of silk, the theory and practice of the art of weaving, designing, drafting, and card stamping. The first year's course embraces the construction of hand and power looms, the consideration of harness, sleys, reeds, and the parts of Jacquard and plain looms as used for making both plain and figured fabrics; the various methods of weighting warp beams and taking down work; winding, warping, and filling, and the machinery employed; counts of cotton and various sizes of silks; the "picking" mechanism of power looms, and the various methods of propelling shuttles in ribbon looms; ties of simple fabrics, and designing and drafting. The second year advances on the subjects treated during the first year, and takes up card stamping and analysis of simple fabrics. In this year are emphasized the reasons for the important place the handloom occupies in silk manufacture. The construction of satins, ottomans, terrys, and single and double faced twills is also thoroughly taught.

The third year advances the student still farther along the lines covered during the first and second years and takes up the following new subjects: The nature and properties of the various European and Asiatic silks and the selection of the most suitable to employ in the manufacture of various articles, the amount of spin and throw calculated to give the best results in the production of different fabrics, counts of yarns and calculations of necessary amount of materials for a certain fabric, the various kinds of charging or weighting silks in dyeing, the manufacture of various kinds of silk fabrics, suitability of designs, perfection of cloth and harmony of colors, and finishing of fabrics. Students are required to prepare and execute a design of not less than 200 ends and 200 picks in each pattern or comber, and also a pattern of plain fabric, and forward the same to London before taking the course examinations of the City and Guilds of London Institute. Every student completing his course of instruction to the satisfaction of the committee is furnished with a certificate which is intended to guarantee that he has a thorough knowledge of the art of weaving. The management of the school urges the attendance of women because of the inviting field offered them in silk manufacture.

The trades and handicrafts department furnishes courses in plumbing, typography, pattern making, and practical carpentry and joinery. There are both theoretical and practical classes in plumbing, but students can not take the practical course alone. The practical class is limited to 12. A two years' course is recommended, but not compulsory. The instruction given embraces theory and practice according to the syllabus of the City and Guilds of London Institute. Since the class is limited to 12 students, boys must compete for admittance. As a consequence this is one of the most successful classes of the school.

The instruction in typography follows the line of examination of the City and Guilds of London Institute. Students who complete the regular course are admitted for instruction on the linotype machine.

The course of instruction in pattern making is thoroughly practical, and embraces the nature and properties of woods used in pattern making; tools, their names and uses; setting and sharpening tools, edge planing, halving, core prints, core boxes, foundry practice, and the relative shrinkage of metals. Students are strongly recommended to take the course in machine construction.

The course in practical carpentry and joinery covers 1 year, and embraces the nature and properties of woods, tools (their names, shapes, uses, etc.), joints used in carpentry and joinery, application of joints to construction, and practical shop work. The number in each class is restricted to 10, so that each student may have a bench and a complete set of tools.

The domestic department includes courses in dress cutting and making and in cookery. The object of the instruction in the dress cutting and making class is not so much to teach the trade of dressmaking as it is to prepare members to cut and fit dresses for themselves. The system taught is that of tailors' measurement, and the instruction is sound, practical, and complete. The cookery course covers plain household cookery, and does not seem to be designed to prepare students for the vocation of cooks as a means of earning a livelihood.

The practical science courses embrace the usual subjects, some of which appear to have been arranged specially as auxiliary to the trade courses.

The school is governed by a technical instruction committee consisting of 38 members, selected annually by the city council. Twelve members of the committee are members of the council. The teaching staff consists of 20 instructors. The enrollment for 1899–1900 was 620. The number of those taking practical instruction was 28 in horology, 37 in silk and ribbon weaving, and 46 in the trades and handicrafts, besides a considerable number taking practical electrical courses.

The school has proved of great practical benefit to the community, in that it saved silk manufacture from a great decline as a possible consequence of the French act of parliament on the export of raw silk.

Labor unions have always been friendly to the school. The typographical union requested that typography be taught in the school. There are no apprenticeship restrictions in Coventry, but former students always enter the shops as apprentices or else serve apprenticeships while attending the evening classes. Students get good wages, and advance rapidly. The work of the school has been very satisfactory in all respects, and is recognized by manufacturers and business men as an essential factor in the industrial and commercial life of the city.

MUNICIPAL TECHNICAL SCHOOL, HOPWOOD LANE, HALIFAX.

The building occupied by this school is about eight years old, but the municipal corporation did not take over the school until 1898. The chief object is to provide instruction in the principles of those sciences which bear directly or indirectly upon trades and industries, and to show by experiment how those principles may be applied to their advancement. The aim of the school is distinct from that of the university colleges, inasmuch as it is designed to teach science solely with a view to its industrial and commercial applications, and not for the purpose of educating professional scientific men. It provides lectures and laboratory and workshop practice for apprentices, journeymen, and foremen in the scientific principles underlying their respective trades and industries, and especially aims to bring to their knowledge newly discovered processes and methods, for the purpose of improving any special trade, or of introducing new branches of industry.

The school is organized as follows: Day departments in wool and worsted spinning and cloth weaving for those youths of 15 years and upward who can devote the whole of their time to study; and day classes in art, wood carving, woodworking, dressmaking, needlework, cookery, laundry work, typewriting, etc. Evening departments and classes for persons already engaged during the day in handicrafts or business.

The courses of instruction are specially arranged for apprentices, journeymen, and foremen employed in the industries of the borough and district, and embrace careful training in technical drawing, especially in the scientific principles upon which these industries depend, together with practice in the laboratories (chemical, physical, mechanical), workshops (engineering, plumbing, woodworking, carpentry and joinery, house painting and decorating), and in the use of appliances, tools, and spinning and weaving machinery; also for the youth of Halifax, destined to a commercial career, a scheme of commercial education has been formulated by the Halifax incorporated chamber of commerce, and the technical instruction committee; also there is a course for women in dressmaking, millinery, needlework, cookery, laundry work, wood carving, and commercial subjects.

Most of the technical classes are under the auspices of the City and Guilds of London Institute, and are intended to give workmen an opportunity of acquiring a knowledge of scientific principles and methods as applied to their trade. Upon the results of these examinations, certificates, prizes, and medals are awarded.

The courses of instruction in the evening classes are designed to give systematic training in the principles of science and art as applied to the commerce and industry of Halifax and district, with especial reference to the following departments: Commercial knowledge, pure mathematics and physics, mechanical engineering, electrical engineering, building trades, chemical industries, manufacture of textile goods, dressmaking, cookery, laundry work, etc., and art. There is no rule confining evening classes to those working at a trade, but the school is conducted on that basis.

The school of commerce provides thorough instruction in such subjects as arithmetic, bookkeeping, shorthand, commercial geography and history, business methods, commercial science, and modern languages.

The engineering courses are designed to fit students to take important positions in engineering workshops.

The chemistry and science classes are arranged with a view to making them thoroughly practical, so that the instruction given shall be of the greatest possible value to artisans and professional men.

Various courses in dressmaking are arranged so as to afford women such instruction as will enable them to do their own family work or to engage in the dressmaking trade. The classes in millinery and cookery are designed to meet the needs of housekeepers.

The instruction relating to the textile industries is most thorough and comprehensive. It embraces designing for all classes of goods, loom construction and tuning, yarn spinning, artistic designing, etc., and every endeavor is made to impart the practical knowledge necessary to fit students for taking important positions in factories. The

instruction is thus of special value to those who are intending to be or are engaged in the spinning of yarns or in the design and manufacture of woven fabrics, in the buying and selling of yarns and woven fabrics, or in the manufacture and export of textile machinery.

The course of instruction in the worsted spinning department extends over three years, and is arranged with the view of giving a comprehensive training in the principles of spinning and their application to the various processes used. The course includes the theory and practice of worsted spinning, technical drawing, textile engineering, practical mathematics, chemistry, and physics, in their application to fibers, material, and the various processes of yarn production.

The complete course is divided as follows: Preliminary course: Worsted spinning (theory), technical drawing, practical mathematics, chemistry, and physics. First-year course: Worsted spinning (theory and practice), textile engineering, chemistry. Second-year course: Worsted spinning (theory and practice), textile engineering. Following is the course in detail:

PRELIMINARY COURSE.

Worsted spinning: Geographical position and relation of wool-producing countries—shearing, packing, and preparation of wool for the markets. Sale of wool, conditions of sale, types of wool and the terms used. Varieties of wool—their characteristic features, as seen in the wools of Great Britain, Saxony, Australia, South Africa, Tasmania, River Plata, and New Zealand. The structure of the wool fiber and its relation to the sheep. The chemical composition and physical properties of the wool fiber. The relation and position of the different qualities in the fleece, relative fineness, etc., of the fibers, weight of fleeces. Impurities in wool—methods of removal. Wool-washing machinery—MacNaught's, Petrie's, Eastwood & Ambler's, Perry's, Hoyle & Preston's; method of treating long, short, and skin wools. Scouring by means of the light oils—methods adopted and substances used. Nature of the soaps and alkalies used—methods of testing their value. The most suitable water and means of testing, temperature of scour—its importance. The utilization of waste scour, and recovery of oil, etc. Principles of drying, effect of moisture. Drying machines—hydro extractor, MacNaught's, Petrie's, Moore's, and others. The gill box. Calculations relating to gill boxes, speeds, drafts. Preparation of long wools, arrangement and description of machines. The knocker-off. Defects in preparing, fallers. Relative speeds and setting of parts. Removal of vegetable impurities, burrs, etc.; the burring machine. Carbonizing—methods adopted. Calculations relating to production, weights, and places where changes are made. Recapitulation.

Technical drawing: Geometry—The use and care of drawing instruments; constructions of regular polygons, general method; inscribed and circumscribed circles; circles passing through three points or touching three lines; constructions required in geometrical patterns, drawing simple tracery, moldings; plain scale and scale of chords; proportional division of lines; plans, elevations, and sections of a simple nature taken from machine details. Free-hand drawing—This course comprises work with the pencil from diagrams and machines, and is intended to enable the student to make sketches, from which he may afterwards make finished drawings to scale.

Chemistry and physics: Chemistry—Chemical distinguished from physical changes; indestructibility of matter; elements and compounds; the action of heated copper

and mercury on air, and of heated iron on steam; production and properties of hydrogen, oxygen, and nitrogen; water, its physical and chemical properties; water for textile purposes; hydrogen peroxide and ozone; the atmosphere, its composition and action on animal and vegetable life. Carbon—Combustion, fuels, etc.; sulphur, its oxides and oxyacids; chlorine; bleaching powder; acids and alkalies; ammonia, arsenic, antimony, phosphorus. A brief account of the following metals and their more important compounds: Potassium, sodium, copper, zinc, magnesium, calcium, tin, aluminum, lead, chromium, manganese, and iron. Physics—The physical properties of the fibers, more especially their density, elasticity, and tenacity; the compound microscope and its application for measuring fibers and yarns; heat, especially the consideration of hygrometry; the construction and use of humidifiers; ventilation; artificial lighting, etc.

FIRST YEAR COURSE.

Worsted spinning: The preparation of short wools—general construction of the carder; relation of the various rollers and their setting; various kinds of rollers; card clothing—materials used for foundations, and kinds of wire; particulars of clothing for long, medium, and short wools—grinding; relative speeds of rollers—calculation; balling head—construction and application; backwashing, its necessity—tinting; substances used; requirements of process—Taylor Wordsworth's machine; Perry's multiple roller backwash; combing—objects of machines used; Noble's comb and accessories, with particulars of circles; Lister's comb; Holden's comb; Platts and Eastwood's comb; tops—their production, treatment of combed sliver, noils, combing results, costing of tops; conditioning and oiling of tops—amount allowed and methods of testing; conditions for sale of tops, commission combing and agencies; recombing and treatment of colored slubbing; carding calculations; combing calculations; recapitulation.

Practical spinning: The practical course in spinning consists of practice in erecting, setting, timing, and working the various machines, and in sampling, mixing, and testing the several varieties of wool slivers, rovings, yarns, and twists. Also in making complete drawings of the machines and their parts.

Textile engineering: Engineering drawing—The use and care of drawing instruments; scales; elementary problems in plane geometry; meaning of plan, elevation, and section; exercises in drawing in pencil some of the following machine details from dimensioned sketches and from actual measurement: Nuts, bolts, rivets, screw threads, nut-locking arrangements, keys, shafting, couplings, bearings, etc. (The examples will be selected almost exclusively from spinning and weaving machinery.) Applied mechanics—Units employed in mechanics; force; specification of a force; composition and resolution of forces; work; unit of work; graphical representation of work problems; work done in actuating the treadles of a hand loom; the mechanism of a steam engine; power; horsepower; moments; the lever, with special consideration of examples found on looms, e. g., treadles, jacks, drawing forward pin and warp governing arrangements; beams; simple machines; wheel and axle; pulley blocks; Weston pulley block; screw press; screw jack; worm and worm wheel, etc.; efficiency of a machine.

Chemistry: Introduction to organic chemistry with regard to the more common hydrocarbons, alcohols, acids, oils, and carbohydrates; the felting of wool and its causes; chemistry of the wood fiber and its natural impurities; scouring and bleaching of wool; testing of soap; alkalies and water; testing of colors; fastness to soap, light, etc; detection of the more important dye materials.

SECOND YEAR COURSE.

Worsted spinning: The various methods of drawing for worsted yarns; objects of the process and their relative merits; open drawing for long, short, and medium

wools; description of boxes and their relation; drawing, knocker off motion, and calculations; open drawing; calculations for drafts, doublings, speeds, weights, and production; cone drawing; cone and lifter arrangements and their relations; calculations for cone drawing; French drawing; reducing and rovings; defects in drawing; spinning—cap, flyer, ring, and mule; spinning calculations; Scaife lifter motion and its application; twisting—Smith's, Farrar's, and Hall and Stell's frames; twisting calculations; stop twisters—Boyd's, Smith's, and Farrar's; winding reeling, warping, beaming; particulars of sale of yarns—methods and conditions of delivery; particulars and cost of machinery; recapitulation.

Practical spinning: The practical course in spinning consists of practice in erecting, setting, timing, and working the various machines, and in sampling, mixing, and testing the several varieties of wool, slivers, rovings, yarns, and twists. Also in making complete drawings of the machines and their parts.

Textile engineering: Engineering drawing—Exercises in drawing in pencil some of the following machine details from dimensioned sketches and from actual measurement: Eccentrics; cranks; connecting arms; wheels, and teeth of wheels; belt and rope pulleys; other selected examples; inking in and dimensioning the pencilled drawings. (The examples are selected almost exclusively from spinning and weaving machinery.) Applied mechanics—Center of gravity; the inclined plane; screw threads; friction; laws of friction; coefficient of friction; angle of repose; velocity ratio; belt, rope, and toothed gearing; section of rim for belt and rope pulleys; horsepower transmitted by a belt; guide pulleys; laws obeyed by falling bodies; energy, kinetic and potential; action of a hammer; fly wheel; strength of materials; load; stress and strain; modulus elasticity; tension; compression; shearing; tension in yarn; torsion of shafts; bending of beams; springs; relation between load and elongation of a spring; calculations on the strength of belts; epicyclic trains; differential motions; the study of mechanical problems as exemplified in various machines in use in the textile department; dynamometer; engine testing.

Practical mathematics: Arithmetic and algebra—Units of length, time, weight, and angular measure; their representation on paper—to scale; the use of decimals; explanation of significant figures, proportion and ratio; multiplication and division, evolution and involution by means of logarithm tables; the use of the slide rule for the same purposes; simplification of algebraic expressions; problems leading up to and including simple equations. Mensuration—The use of formulæ for finding areas and volumes; approximate formulæ; practical methods of finding the same; use of planimeter; the use of squared paper for finding volumes from varying cross sections; weights derived from volumes; densities; meaning of center of gravity and easy methods of finding it; the use of squared paper in representing the results of experiment and the correction of errors; significance of ordinates; slope of curve and inclosed area; application to the work done by varying force. Geometry—Measurement and functions of angles; graphic methods of ascertaining their values; use of tables of functions and their logarithms; evaluation of formulæ involving algebraic and trigonometric terms.

For students engaged in weaving and designing, a complete course, extending over three years, has been arranged, and students are earnestly requested to follow the whole course.

FIRST YEAR COURSE.

This course embraces lectures on weaving and designing, practical work in the the weaving shed, lectures on color in textile design, free-hand drawing, and lectures on ornament and design. Students must take the whole of this course unless permission is obtained from the principal to omit any portion of it. Lectures are

given on the following subjects: Designing—The elementary principles of cloth construction, including the consideration of plain and twilled cloths; also modifications of plains, such as ribs, hopsacks, etc.; the production of simple weaves; sateens and the derivation of new weaves from the sateen; twills, etc., formed by the combination of two or more weaves; sateen rearrangement of twills, etc.; the principles of producing elongated and fancy twills; stripe and check designs, and drafting to weave on the lowest number of healds, and pegging plan of the same. Application of the principles demonstrated in the foregoing to dress fabrics, such as cashmeres, lustres, silks, etc.; worsted and woolen trouserings, coatings, overcoatings, and mantle cloths. Calculations—The principles of counting yarns, in worsted, woolen, cotton, and silk; changing from one denomination to another; finding the weight of warp and weft, and the cost of producing simple fabrics; the principle of counting the sett for local and other districts. The analysis of pattern—The analysis of the simpler makes of cloth, including the methods used for obtaining the counts of yarn, threads, and picks per inch; colors used and weight of each will be thoroughly taught. Loom—The hand loom; its construction and various movements; its modifications for special classes of fabrics, etc.; elementary principles of power-loom weaving. Practical work—Each student will be required to design, mount, and weave ranges of patterns.

The importance of color in textile design can not be too highly estimated. The keen competition which is experienced by the manufacturer of woven textures to-day, not only calls for men well versed in the technicalities of cloth construction and the principles of designing, but equally for good colorists, for naturally he who can introduce the best assortment of colors into his woven design will most readily find the best market. To treat the subject as thoroughly as its importance demands is almost an impossibility in the ordinary course of lessons on designing and weaving. Special facilities are therefore offered to those students who desire to study the subject more in detail, as follows: I. Color theories; prismatic experiments; comparison of prismatic and pigment colors; simple and compound colors and mixtures; characteristics of various colors, including an explanation of hues, tones, tints, and scales; modification of contiguous (simultaneous) colors, including textural and surface modifications; harmonious coloring; harmony by analogy and contrast. II. Effects obtained by combination of weave and color; hair-line and bird's-eye effects; step, shepherd's plaid, and star patterns; stripes and checks in black and white or color; schemes for simple and compound coloring; application of color to special weaves, e. g., corkscrews, modified corkscrews, rib styles, fancy woolen weaves, diagonals, and double-weave effects; spotted effects for vestings, etc.; application of color to figured fabrics; modification of effects by the introduction of variously colored twist threads. Without a thorough study of this subject no student can reasonably expect to succeed in the City and Guilds examination in cloth weaving.

The course of free-hand drawing comprises drawing from outlines, from textiles, and from natural flowers and foliage, followed by a lecture course on ornament and design, each student being required to sketch the examples and make notes of the lectures given.

SECOND-YEAR COURSE.

Lectures are given on the following subjects: Designing—Special consideration of the development of figure by means of weave; weave effects on a sateen basis; spot figures; diagonal figures; changing diagonals to stripes and vice versa; backed cloths warp and weft; double cloths; principles of tying; reversible double plain and twilled fabrics; unions; spotted diagonals; elementary principles of gauze weaving and crammed stripes; the various methods of utilizing extra warp or weft for additional weight, figuring, or both in combination. Calculations—Resultant and average counts; mixed and folded yarns; cost of producing a piece; diameter of yarns; changing

weight of cloths; quantities of each color required in warp and weft, in stripes and checks. Analysis of patterns—Single cloths; backed cloths; double cloths. Loom—Its various movements; details of the principal dobbies; the Jacquard machine, its use and principles.

THIRD-YEAR COURSE.

Special instructions are given in the development of figured textiles, the means adopted for the development of figures, and the application of color. The subjects treated are as follows: Designing—Triple and multiple cloths; gauze weaving and designing; crepons and special cords; poplins; matelasses, tapestries, and quiltings; pile fabrics, including velveteens, corduroys, velvets, and plushes; principles of designing and coloring of tapestry, Brussels, Wilton, Axminster, and Scotch carpets. Calculations—Relative diameters of yarns; setting of fabrics; changing from single to double cloths under varied conditions; changing weight and pattern; miscellaneous problems. Analysis—Double cloths; figured cloths; gauze cloths; plush. Loom—The principles of various dobbies; shuttle-box mechanisms; sliding pick arrangements; swivel weaving; its chief improvements; the mechanism of the Brussels-carpet loom. The Jacquard machine—Its construction and the various descriptions of mounting, including compound harness, split harness, reverse and border ties, and double-lift machines with all latest improvements. Cloth finishing—The various processes through which the fabrics pass after leaving the loom; the different classes of finish, as doeskin or dress face, velvet, Melton, or Scotch, and dry or bare finish; the effects of scouring and milling upon design.

In the builders' work department extended courses are given in geometry, building construction, masonry, carpentry and joinery, plumbing, and painters' and decorators' work.

The course of instruction in plumbing is intended to meet the requirements of apprentices, journeymen, and master plumbers who desire to obtain a sound knowledge of the principles and technical processes of the trade. It is further designed to meet the needs of those who wish to gain instruction in the theory and practice of sanitary engineering. The complete course extends over three years, and includes instruction in technical drawing, workshop arithmetic and mensuration, elementary physics and chemistry, and the theory and practice of plumbing.

The course in painters' and decorators' work consists of lectures and lecture demonstrations, drawing and design, and practice in the workshop extending over two years.

The school is managed by the technical instruction committee of the county borough of Halifax. This committee consists of the mayor and 23 other members, 12 of whom are councilmen and 3 are representatives of the Worshipful Company of Clothworkers.

All the teachers of practice have been practical workmen—the plumbing teacher a master plumber; the spinning teacher a foreman; the weaving teacher a designer, etc.

During the year 1899–1900 there were enrolled 1,644 students—nearly all in evening classes. The number of entries in practical classes were as follows: Carpentry and joinery, 14; masonry, 6; wood-

working, 10; wood carving, 13; house painting, 27; typography, 27; plumbing, 44; spinning, 17; weaving, 47; cloth construction, 9; and textile designing, 24.

Students are preferred by employers, and they advance rapidly and command better wages than those who have not had school advantages.

TECHNICAL COLLEGE, HUDDERSFIELD.

This school had its origin in 1840 as the Young Men's Mental Improvement Society, the main object of which was "to impart good instruction at the cheapest rate." In 1843 the name of the society was changed to the Mechanics' Institution. The idea of technical instruction first took form in 1844 in the provision for classes in mechanical and architectural drawing. A school of design, as it relates to the woolen industry, was established in 1848. Other departments followed these from time to time until in 1877 the Technical School and Mechanics' Institute was established. In 1883 the present building was opened at a cost, including equipment, of more than £12,000 ($58,398), and the name was changed to the Technical College, Huddersfield. Since 1883 nearly £12,000 ($58,398) has been expended in making additions to the grounds, building, and equipments.

The advanced courses of study are especially adapted to students who are 16 years of age or over, but younger persons may be admitted. The classes are open to both sexes. The fees vary according to courses taken and privileges granted. Prizes and scholarships are offered in many of the departments, and in 1900 they amounted to about £200 ($973). Persons who contribute 1 guinea ($5.11) annually, or make a donation of £25 ($121.66) to the college funds are privileged to name one junior student, who shall be permitted to enter classes at half the regular fees, and an annual subscription of £5 ($24.33) entitles the donor to name a senior student with the same privilege. Trustees of charities or other public bodies who contribute £25 ($121.66) annually can name 2 day students or 4 night students, or 1 day and 2 night students, who shall be entitled to free tuition.

The work of the college is divided into day, evening, and evening continuation classes. The day classes provide systematic courses in languages, art, biology, mathematics, physics, and electrical engineering, civil and mechanical engineering, chemistry, dyeing (wool, cotton, and silk), cloth weaving and designing, economics, commerce, university courses of study, education and method, and domestic economy. The evening classes cover practically the same subjects, and in addition to these are courses in mining and physiography and geology. The continuation classes are of an elementary character and are designed to prepare students for entrance to science and technical classes in the regular day or evening courses.

The courses of an essentially technical or trade character are outlined in some detail:

Weaving and pattern designing: The full course in the day classes is intended thoroughly to equip a student with all the technical knowledge and skill necessary in designing worsted and woolen cloths, shawls, rugs, mantlings, and vestings, and to impart a knowledge of the principles underlying the structure and ornamentation of all kinds of textiles, so that the student is qualified for a position as assistant manager or designer. The full course extends over three years, and a fourth year's work is provided for those who wish to pursue their studies along special lines. The lectures embrace the construction and running of various hand and power looms; setting and timing the various parts of looms, warping, sizing, and beaming machinery; card-cutting and repeating apparatus, systems of numbering reeds, harness building, modifications of the Jacquard power loom, points in loom which cause defects in cloth, loom calculations, etc.; designing textures, such as hop-sacking, twills, whipcords, double, treble, and multiple cloths, vestings, ribs, shawls, etc.; effects of various applications of colored threads, etc.; pattern analysis, including the dissection of all kinds of single, double, and multiple fabrics; counts of yarns, particulars of colorings, shrinkages, and weight, and cost per yard; the drafting of any design on its lowest number of heald shafts, calculations relating to diameters of threads, and, in fact, every variety of textile calculations; the construction of yarns, differences between woolen, worsted, cotton, mohair, and silk yarns; yarn testing, counting yarns, effect of various kinds of yarns in the finished cloth, etc.; the general principles and applications of color—harmony, contrast, etc.; the general characteristics of raw materials, and a general knowledge of finishing for various classes of goods in all its processes. More than half the time devoted to the entire course is spent in practical weaving, designing, and drawing. The work of the evening classes is not claimed to be so systematic as that of the day classes, and seems to be designed more for the special needs of workmen.

Students who have not had sufficient scientific training find a special auxiliary course of two years which is designed to meet their requirements, and they are expected to take it before beginning the regular textile course.

Dyeing: The full course in dyeing extends over three years. It is intended to give the sons of masters, managers, or foremen, or others who may wish to enter chemical or dye works, a knowledge of the sciences which underlie the industry of dyeing, and to train them to apply their knowledge to practice. The course covers mathematics, organic and inorganic chemistry, physics, mechanical drawing, French, German, and practical work. Chemistry and practical work occupy important places in the course, the third year being devoted almost entirely to practical chemistry and dyeing. The lecture course includes such subjects as water, wool fiber, vegetable fibers (their composition and structure), mercerizing, dyes, mordants, fixatives; value of commercial dye wares, mordants, scouring and bleaching agents, artificial colors, special treatment of the various substances and fabrics to be dyed, compositions of dyes, calculations for costs, etc. Third-year students are allowed to conduct research work along lines of special interest to themselves.

Carpentry and joinery: This course is arranged to meet the requirements of students preparing for the examinations held by the City and Guilds of London for carpenters and joiners. The course extends over two years.

Hand railing and stair building: The class is intended to give carpenters, joiners, builders, and others a theoretical and practical knowledge of this difficult and interesting work. The course consists of 30 lessons, not less than 6 of which must be practical work. The syllabus includes planning and constructing the various kinds of modern staircases, manner of fixing strings, treads, risers, etc., construction of stone, concrete, and iron steps, and designing, molding, wreathing, and fixing hand rails.

Plumbing: This course is arranged to meet the requirements of plumbers and apprentices who desire to gain a practical knowledge of plumbing and of the elementary scientific principles underlying the trade. The course of instruction extends over three years, and includes arithmetic, drawing, physics, alloys, solders, properties and uses of materials, roof work, hot-water apparatus, sanitary appliances, arrangement of water service in buildings, uses of tools, etc. The practical work embraces proficiency in marking and cutting out sheet lead, bending pipe, making joints in such positions as will occur in actual practice, and lead bossing.

Dressmaking: The course includes cutting and fitting by measurement, drafting, and practical cutting out, making up, finishing and trimming of standard modern dresses. Drafting lessons include instruction in the cutting and fitting of both bodices and skirts. The making-up lessons cover selection of material and lining, manipulation of different materials, quantity and cost of articles used, and the management of the various fastenings and stitches. In accordance with the City and Guilds of London examination, no charts of any kind are used. A special course of instruction is arranged for students (elementary teachers and others) who intend to present themselves for the City and Guilds examinations in dressmaking for a certificate, and only such students will be admitted.

Millinery: The course comprises the making and trimming of hats, ladies' dress caps and bonnets, including children's millinery in the best styles; the making of bows in various ways, and the management of velvet, straw, lace, tulle, etc., used in millinery. Arrangements are made whereby students desiring to sit for the examination in millinery in order to gain the certificate of the City and Guilds of London Institute may do so. The examination is practical and written, to show the candidate's knowledge of the materials mostly worn; also the drawing of diagrams illustrating the various processes in millinery, viz, drawing a diagram of a hat or bonnet, and showing how the different parts should be placed on the material; renovation of different materials and terms belonging to millinery; estimating quantity and cost of trimmings for hats to match certain costumes.

The art department provides a course in wood carving embracing both theoretical and practical instruction of an elementary and advanced character. There is also a course of 12 lectures, accompanied with practical exercises, in applied designs for printed goods, wall papers, enameling, embroidery, etc.

The engineering courses include lectures, drawing practice, laboratory and shop practice, and the necessary mathematical and scientific training and instruction in physics.

The college is administered by a board of governors, consisting of a president, a treasurer, 5 ex officio governors, 15 elective governors, and a number of nominated governors appointed by certain charities and other public bodies which contribute to the support of the college.

The full corps of teachers for the entire college consists of more than thirty lecturers and assistants. Three of the practical teachers have served time as apprentices, and weaving and dyeing are taught by medalists of the City and Guilds of London Institute.

The total enrollment of the college for the year 1899–1900 was 1,326, of whom 415 were day students and 911 were in the evening classes. The entries in technical and trade classes were as follows: Cloth weaving, 151; dyeing, 32; carpentry and joinery, 34; wood carving, 13;

dressmaking, 21; millinery, 12. More than five-sixths of those in practical work were in evening classes.

So high is the estimation placed by some manufacturers upon the work of the school that they require their apprentices to attend evening classes, and one employer pays their fees. One large firm of worsted manufacturers claim that their business was much helped by former students. The large number of designers educated in the school has benefited the town.

The work of the college has been satisfactory. Its students find employment at better wages than those who have had no school training, and they advance rapidly in their trades.

TECHNICAL SCHOOL, KEIGHLEY INSTITUTE, KEIGHLEY.

In 1825 four workingmen were instrumental in forming a society for mutual instruction in mechanics, experimental philosophy, and mathematics. This was the beginning of the Keighley Mechanics' Institute, and from that school was evolved the present institution, which was opened in 1870. Within a few years the building opened in 1870 became so crowded that an extension was necessary, and in 1887 a new wing, nearly doubling the space, was opened. The building as it now stands cost about £32,000 ($155,728) and no part of this cost came from the public treasury. The Clothworkers' Company, of London, was a liberal contributor to the building fund, and the balance was raised by private donations.

In the establishment of the school the main object was to supply scientific and technical instruction to apprentices and others engaged in local industries; but it was soon found desirable to establish a day school to afford such instruction in science and art as would prepare students for an industrial or commercial career. So the trade and grammar school endeavors to combine the purpose of the practical and classical schools of Germany. Pupils are admitted at any time and fees charged from date of entrance, but no boy can withdraw from the school without first giving a term's notice in writing or by paying a term's fee. The fees vary according to the course taken, and they are invariably payable in advance. There are open to students a number of exhibitions, prizes, and scholarships, ranging in value from 10s. to £60 ($2.43 to $292) per year, besides book and other prizes offered for general success, regularity, punctuality, and good conduct.

The work of the school is divided into the following schools or classes: School of art, science school, technical classes, textile department, commercial classes, and domestic classes. Following are given details of the courses in technical and trade instruction and outline of other courses not properly within the scope of this inquiry: In the school of art the course of instruction is that appointed by the art department of the board of education at South Kensington, and is, as

far as possible, adapted to the individual wants of each student. The council offers encouragement to all work done in the school which is applicable to the trades of the town, and students are also encouraged to take up applied arts, such as repoussé in metal, modeled leather, pyrography, wood carving, etc. Preparatory work for designers is made prominent, and a fairly good course in wood carving is provided.

The department known as the science school offers a course in geometry which is intended to be sufficient for all the ordinary requirements of draftsmen, besides courses in machine construction and drawing, building construction and drawing, mathematics, mechanics, chemistry, botany, steam, and physiography.

No student is allowed to take a practical course in the technical classes in the woodworking and building trades department without a corresponding theoretical course, except by special permission; nor can he take up the work above the first year unless he shows himself to be qualified in the subjects of the preceding courses.

The course in carpentry and joinery embraces both theoretical and practical training. The practical work of the course is of such a character as to test the student's ability as a craftsman, and embraces all the operations necessary to that purpose.

The brickwork and masonry courses include theoretical instruction concerning the various materials used and the different kinds of work in the construction of brick or stone buildings, walls, etc., together with a knowledge of tools and the details of finishing.

The course in plumbing is similar to others already described and occupies three years. The work of the second and third years is supplemented by practical work, whereby students may learn to put into practice the principles taught in the theoretical classes.

The textile department offers the following courses, which are given in detail:

Wool and worsted spinning: This complete course extends over three years. The first year covers raw materials, their clothing properties, physical structure, and microscopic appearance; wool substitutes, their production and uses; woolgrowing countries; the special kinds of yarns and fabrics for which the wools are used; the classification of the different qualities of fleece for woolen, worsted, mohair, and alpaca yarns; relative fineness, elasticity, strength, and spinning qualities of the different sorts of wool in the fleece; scouring in all its phases; drying, and the construction of drying machinery; burring, tearing, blending, oiling, and calculations. The second year's work embraces the preparation of wools for worsted yarns, including the entire routine, construction of the worsted carder, the construction of woolen carding engines, and the differences between woolen and worsted carding; fixing and grinding card clothing; card-fed appliances and garneting; backwashing machinery and the objects and effects of backwashing processes; different kinds of combing machines; calculations on wheel gearing and on casting for the preparation of the top in worsted yarn making, etc.; the general points of difference between woolen and worsted yarns, and the uses of cotton and silk threads in the worsted and woolen trades. The third year's course embraces condensing woolen yarns and the processes of drawing worsted

yarns; roving and roving frames and mule spinning; spinning machines for worsted yarns, twist yarn, and twisting frames; processes of gassing, genapping, reeling, and bundling; calculations on casting of yarn making from the raw material to the spun thread; on compound threads, and on speeds of machines and their output; special qualities of threads for particular uses; the defects of yarns, their causes, and remedies; and testing fibers, yarns, oils, and soaps. Complete provision is made for carrying on successful practical work in connection with the entire theoretical course.

Weaving and designing: This course is graded to suit the requirements of overlookers, managers, and practical designers, and covers three years. The subjects included are yarns and reeds, drafting and healding, cloth structure (plain, backed, double, treble, and compound), various kinds of hand and power looms, including Jacquard; pattern analysis, designing and coloring, structure of fabrics and fabric analysis, and finishing. Ample machinery for practical work is supplied and nothing is spared to make the course very thorough and complete.

Besides this regular course there are special classes in cloth structure, analysis, yarn testing, and the study of color.

Commercial classes provide instruction in Latin, French, German, bookkeeping, shorthand, and general commercial subjects. The domestic department provides instruction in laundry work suited to the needs of the housewife, courses in plain cookery and in plain and fancy needlework, besides the following more comprehensive courses in dressmaking and millinery: The former course consists of elementary and advanced work in drafting patterns, cutting and fitting by measurement, making dresses, bodices, jackets, skirts, waistcoats, fancy sleeves and collars, and dressing gowns. Instruction in the latter class includes drafting by measurement; cutting and making shapes from buckram and wire; trimming hats; renovating hats and trimmings; curling feathers; making ladies', servants', and children's caps; and retrimming with old materials.

The school is at present (1901) under the control of the county council, but its control is soon to pass to the city. The teaching staff consists of an ample number of competent instructors in all departments.

In 1899 there were enrolled 1,650 pupils, of whom about 1,300 were in the night schools. There were 100 in building construction; 72 in textiles; 50 in woodwork, carpentry, and joinery; 28 in plumbing; and 16 in masonry.

The school has promoted a diversity of industries in the town, such as engineering, tool making, machine making in general, especially laundry and mill machinery, and sewing machines. It is not claimed that the establishment of any of these industries is due to the school, but it is pointed out as significant that a large proportion of the employers, foremen, and directors in the industries of the community were at one time students in the school. Keighley has for many years held supremacy in the making of long-wool machinery for worsted spinning and certain branches of weaving.

Day scholars usually leave school at 18 to 19 years of age and generally get lower wages than others until they are 21, then they get higher wages. The students generally advance very rapidly.

YORKSHIRE COLLEGE, LEEDS.

The Yorkshire College was founded in 1874. It was at first called the Yorkshire College of Science, and the courses of instruction were limited to science, pure and applied; but in 1877 languages, literature, and history were added to the subjects previously taught, and the name thereupon altered to that which it now bears. The range of subjects was rapidly extended; courses of study in the various university faculties, both for ordinary and for honors degrees, were established or developed; and strenuous efforts were successfully made to increase and perfect important branches of technical instruction. In 1884 the Leeds School of Medicine, which was established in 1831, was incorporated in the college as its department of medicine, and in 1887 the college entered the Victoria University as one of its three constituent members.

The college offers complete courses for the degrees in art, science, medicine, surgery, and law of the Victoria University; and for the professions and occupations of civil, mechanical, electrical, mining and sanitary engineering, analytical chemistry, cloth manufacture, dyeing, leather manufacture, agriculture, and law, it provides lectures and classes in subjects of general education suitable to those who desire to continue their studies beyond the point reached at school.

The cost of the buildings, with their equipment, together with the land, has been about £155,000 ($754,308). The medical school was built in 1894, at a cost of about £50,000 ($243,325), to accommodate the department of medicine of the college.

The buildings consist of the following, named in the order of the date of their erection: (1) The textile industries department, erected and equipped by the Clothworkers' Company, at a cost of £16,000 ($77,864), and opened in 1879. (2) The main art and science buildings, erected and furnished at a cost of about £55,000 ($267,658), and opened in 1885. These buildings are of red brick, with stone facings, and are in Gothic collegiate style. (3) The dyeing department and additional weaving sheds, erected and equipped by the Clothworkers' Company, at a cost of £14,000 ($68,131), and opened in 1885. (4) The engineering department, erected and equipped, at a cost of about £10,000 ($48,665), from funds raised by the engineers of Leeds and the district. (5) The college hall and library, erected at a cost of about £22,000 ($107,063), and opened in 1894. (6) The art department, erected by the Clothworkers' Company, at a cost of about £3,500 ($17,033), and opened in 1895. (7) The leather department, erected by means of a grant of £5,000 ($24,333) made by the Skinners' Company. (8) The carding and spinning department and extensions to the dyeing department, both in process of erection (1899) by the Clothworkers' Company, at an estimated cost of £25,000 ($121,663). All the funds for the buildings and equipment except £60,000 ($291,990), provided

by the Clothworkers' Company, have been furnished by private subscriptions.

Day students must have attained the age of 16 years, and those under 17 are required to pass an entrance examination in arithmetic, including decimals and proportion; algebra, to simple equations; geometry, first book of Euclid, or its equivalent; and English composition and dictation. Candidates for admission who are under 19 years of age and who have been at school within one year of their application for admission must produce a certificate of good conduct from the head of such institution. Each student attending a class in which the fee is £1 1s. ($5.11), or more, is required to pay, in addition, a registration or library fee of £1 1s. ($5.11). A subscription of 7s. 6d. ($1.83) to the Students' Union is obligatory (with certain exceptions) on students attending the college more than six hours per week. This subscription entitles students to the use of the common rooms (which are supplied with the daily papers, current periodicals, etc.), to free instruction in the college gymnasium, and to the use of the athletic grounds and tennis courts. No registration and library fee or sessional fee is charged in ordinary evening classes or those which are held for occasional students.

Of the various courses offered by the college and heretofore enumerated, only the courses provided by the Clothworkers' Company—namely, textile industries in their various branches, dyeing, and art—and the course in leather manufacture come within the scope of this inquiry.

The textile industries department has been in successful operation for more than twenty-five years.

The department comprises the following branches: Woolen yarn manufacture, worsted yarn manufacture, designing, weaving, and textile manufacturing, and finishing of textile fabrics. Each branch possesses a complete plant of machinery designed and constructed for the demonstration of the technicalities of the various processes of spinning, weaving, and finishing. Part of the work of the department is carried on in conjunction with that of the dyeing department, so that the whole routine of textile production from the raw material to the finished fabric may be as practically learned at the college as in the mill.

The courses of study comprise both day and evening classes. The principal day course is that in which certificates of proficiency in designing, manufacturing, and spinning are awarded, and covers three years; but there are also special short courses of one and two years for students who have already had a preliminary training in other schools or in factories, and a teachers' course held on Saturday afternoons. The lectures, divided into first, second, and third year courses, relate to the subjects of designing, weaving, coloring, cloth finishing,

and spinning. The designing and weaving course deals with the principles of fabric structure, the methods of developing design in the loom, the construction of weaving machinery, calculations on the weight and cost of yarns, fabrics, and speed of looms, yarn testing, and the analysis of single and compound fabrics. The lectures on textile coloring relate to the science and technology of the application of color to woven design, and to the effect which the nature of the material, yarn, and fabric has upon combinations of color, and to the methods by which patterns are obtained by varying the weaves, and the schemes of warping and wefting. The cloth-finishing course treats of the process of finishing, of the construction of finishing machinery, and of the styles of finish applicable to the different materials of which the fabrics may be composed. Lastly, the spinning course deals with all processes from the raw material to the spun yarn, and to the construction, setting, and working of the machinery used in both woolen and worsted yarn manufacture.

The evening classes cover three or four years' study, and are held on four evenings in the week. The subjects dealt with are designing in all classes of plain and fancy fabrics, weaving mechanism, and textile coloring. The system is similar to that practiced in the day classes, but necessarily it can be neither so comprehensive nor elaborate. Each student, as in the day class, has a separate loom.

In the elementary day class each student is entitled to the range of samples he himself produces. During the session he has the opportunity of weaving on looms arranged for showing the effects of drafting, coloring, and diversifying the counts of yarn and setting, and he obtains a fair assortment of samples illustrative of typical schemes of weaving. The system of pattern work in the advanced day classes makes each student a contributor to and participator in all the results of the loom experiments of his class. The woven specimens are periodically distributed and entered in specially designed pattern books, accompanied by all weaving data, such as weight per yard, widths and lengths out of loom and finished, the percentage of shrinkage, and routine of finish.

An advanced students' book is mounted with samples of single and compound fabrics in woolen and worsted trouserings and suitings, coatings, heavy cloths, dress fabrics in worsted, silk, cotton, and mixed materials, vestings, rugs, mantles, shawls, plushes, and decorative textures. The experiments on the looms and finishing machinery are as practical as similar work in the mill, but of a distinctly educational nature. Research forms an important part of the loom work done by third-year students.

In addition to demonstrating the nature, object, and effect of the processes through which the fabrics pass in finishing, and the use and methods of setting and working the different machines for scouring,

milling, raising, cutting, etc., students learn the relative properties of scouring ingredients, the qualities a cloth ought to possess when made for special routines of finish, and how to test and determine the conditions imparted to the fabric in any particular process. As in weaving, the course is graduated, the operations being dealt with in natural order of sequence.

The main purpose in the equipment of the spinning branch is to provide apparatus and machinery for the accurate investigation of the materials used in manufacturing, and of the nature and effect of the different processes in yarn construction. While in every sense the work is designed on such lines as to be as practical as that performed in the mill, it is better systematized, and comprises the keeping of exact records of the data arrived at by scientific tests. The primary use of the machinery, which affords facilities for treating wool and wool substitutes from the raw material to the spun thread, whether worsted or woolen, is the manufacture of yarns for the weaving classes, but a subsidiary yet equally important purpose of the department is the examination of the fibers, and the testing of the materials and yarns, as well as the fabrics produced from them.

The department possesses a well-equipped laboratory, as well as the necessary rooms for scouring, mixing, scribbling, carding, combing, drawing, spinning, warping, and beaming machinery. This department thus, in conjunction with those for dyeing, weaving, and finishing, makes it possible not only to teach experimentally as well as theoretically the art of cloth manufacturing from the raw material to the finished fabric, but to provide for the systematic testing of materials in the different stages of manufacture.

In the dyeing department instruction is given by means of lectures and laboratory work, the latter being carried on in the experimental and practical dyehouses and in the research laboratory.

The lectures deal with the fundamental elements and principles of dyeing, and include such subjects as the textile fibers, operations preliminary to dyeing, water, mordants, machinery, theories of dyeing, natural and artificial coloring matters, their methods of application, etc. The lectures are fully illustrated by means of experiments, diagrams, dyed patterns, and specimens of dyestuffs; also with lantern slides of machinery, etc.

The experimental dyehouse is open daily, and students work at times convenient to themselves for periods varying from 6 hours to 36 hours per week. Each student works independently, having a working place, apparatus, dye vessels, etc., under his own control. During the earlier period of study a definite course of work is pursued, but later on a student may devote himself more particularly to the special branch of dyeing which he intends eventually to follow.

The work consists in carrying out an extended and systematic series

of dyeing experiments on a small scale, the object of which is to determine the dyeing properties of all the various coloring matters employed in practice, as well as of new dyestuffs. The effect of time, temperature, concentration of the dye liquor, the employment of various proportions of mordants, assistants, etc., is studied. According to the requirements of individual students, instruction is also given in the dyeing of union fabrics, silk, leather, straw plait, skin mats, etc. Practice is further given in the dyeing of compound shades, color matching, the determination of the commercial value of dye wares, the detection of the coloring matter on dyed materials, etc.

Special instruction is given, when required by a sufficient number of students, in the printing of woolen fabrics. The color-mixing and printing rooms are provided with the necessary apparatus for making experiments on a small scale, e. g., color pans, steaming chamber, printing machine, blocks, etc.

Concurrently with the foregoing, the students carry on the important work of testing dyed colors with respect to their behavior toward various agents and manufacturing operations.

The practical and pattern dyehouses are open to advanced students at stated times. Under the guidance of a specially appointed assistant the students are engaged in dyeing, in a large variety of colors, from 5 to 20 pounds of material, in its various forms of loose wool, slubbing, tops, yarn, and cloth; the material is supplied by the textile industries department and is returned in the dyed condition for further experimental work in spinning, weaving, or finishing in that department.

The course of study in textile art, or decorative design for textile fabrics, is arranged under two schemes, one for those who wish to make the decorative side of textile work their special study and the other for those students who are taking the ordinary textile course. In both schemes the technological and artistic sides of textile work are carried on together, and the course is so arranged that students are taught not only to make designs but also to work them out on the loom. The practical exercises and lectures for first-year students are of a preparatory character, the purpose throughout being to secure as much skill in drawing as possible, to make the student familiar with the fundamental principles of repeating patterns, and to develop good taste and artistic feeling.

The second-year course takes up original design both in the lecture course and in the practical work. The lecture course deals with the elements and principles of ornament as applied to textile fabrics, and the practical work in the art studio consists of designing for various classes of woven tissues, the work being done under the direct supervision and advice of the art lecturer. When arrangements can be made for the designs produced by the students in the art class to be woven, they are worked by them on point paper and carried out in the looms of the textile department.

Special attention is given to the study and use of plant forms for design purposes, and the equipment of the department includes a very useful series of drawings in color from natural plant forms, which can be used when the actual plant is not readily obtainable.

The third-year course of study is intended to give students the opportunity of devoting themselves to that special class of textile work in which they particularly wish to qualify and to enable them to acquire a more thorough grasp of the possibilities of design. Those who possess marked ability in the direction of decorative design or who intend to enter some weaving industry in which applied art is an important factor are encouraged to attend more than one day per week in the art studios.

The class in design for the decorative arts includes a course of lectures on the principles and elements of ornamental designing, together with practical work in the design studio. It is intended for those wishing to take up decorative art of various kinds other than textile design, the course in the latter subject, already referred to, being of too special a character to be suitable for those who wish to prepare for other kinds of decorative work. It is attended by architectural students, decorators, wall-paper designers, and women interested in such home arts as embroidery, wood carving, gesso work, stenciling, repoussé work, and design in black and white.

It may be stated generally that the object of the instruction given in the leather industries department is, in the first instance, to familiarize students, both by lectures and the practical handling of materials, with the details of the tanning processes and the reasons why particular modes of treatment produce particular effects. Methods of chemical and microscopic analysis are also taught and practiced to determine purity and value of materials. In the latter part of the course students are encouraged to attempt the practical production of leathers in which they are interested. Instruction is arranged in three schemes, so as to meet the requirements and conditions of as great a number of students as possible. The first scheme provides for a three years' course, qualifying for certificate of proficiency in leather industries and chemistry. This course is suitable for those who intend to become technical chemists in the leather industries or managers of important works. The study of pure chemistry of university standard is pursued through the full three years. Besides chemistry, the full course embraces mechanical drawing, German or French, physics, dyeing and staining, methods of manufacture, technical microscopy and bacteriology, and abundant laboratory work. A systematic course of manufacture is carried on in the experimental tannery, and all the processes of production of leathers are conducted by the students themselves. The character of this experimental work is arranged to suit the individual needs of students.

The second scheme provides a two years' course designed to give a good knowledge of the principles of leather manufacture and of the chemistry which it involves, and is suitable for managers, sons of manufacturers, and foremen who can not afford the full three years' course. This course is insufficient for those who wish to qualify as technical chemists.

The third scheme provides a one-year junior course for students who require only a slight general knowledge of the subject, and who can afford to devote only a single year to study. Students must have some preliminary knowledge of chemistry. The course covers, in a brief and general way, most of the subjects mentioned in the first scheme.

Special courses may be arranged for students who have an adequate knowledge of some of the subjects in the regular courses. Some preliminary acquaintance with actual leather manufacture is very desirable before taking the college course, and in no case is the college training considered an adequate substitute for practical experience in actual manufacture.

The fees (including entrance and union fees) for the various courses in textiles and dyeing range from £10 to £33 ($48.67 to $161) per year. Those in the leather school range from £1 11s. 6d. ($7.66) for some of the special courses to £33 9s. ($163) per year for the regular courses.

In 1901 there were 687 students in all evening classes. During the year 1899–1900 there were 226 entries in the textile industries department—164 in day classes and 62 in evening classes. There were 92 entries in the dyeing department—69 in day classes and 23 in evening classes. In the art department there were 138 entries—128 in day classes and 10 in evening classes. The total entries, therefore, in these departments numbered 456, representing 277 individual students.

The textile teaching at the college has directly benefited the weaving industries of the country, and the trade of Leeds in woven manufactures has been almost entirely changed since the beginning of the classes in 1875. The instruction given in the dyeing department is of such a character as to enable a student to enter at once and with success into the duties of practical work. From time to time applications are received from manufacturing firms for qualified students competent to assist in dyehouse work or to direct the same, and it is frequently possible to recommend students for more or less responsible positions.

Students of this department have been appointed, at one time or another, to superintend the teaching of dyeing in other technical schools, and many others are occupying prominent positions in various firms.

The influence of the department on industries to which art is applied has been undoubtedly felt, not only in Leeds and Yorkshire, but also

in the wider area from which students are drawn to the college. There was at one time great prejudice among English employers against school-taught dyers, but this condition has gradually changed until now employers seek technically-trained men. A few employers pay part of the school fees of apprentices in the night schools.

LEEDS INSTITUTE OF SCIENCE, ART, AND LITERATURE, LEEDS.

The Leeds Mechanics' Institution was established in 1824. New departments were added from time to time, and in 1868 the present building was opened. In 1889 was established the Leeds School of Science and Technology, and in 1897 the institution took its present name and was organized with five departments. A year later two other departments were added, making seven as now organized.

Youths from 13 to 16 years of age may enter for the junior course. The senior course is designed for those above 16 years. Every student must attend at least twenty-five lectures, unless prevented by sickness or by working overtime; he must work the exercises given out weekly by his teacher and send them in for examination; and he must attend the examinations of the board of education or City and Guilds of London Institute, at the end of the session, in connection with each class he attends. The fees charged regular students range from 2s. 6d. to 15s. ($0.61 to $3.65) per session, according to the course taken and the number of subjects embraced. Fees for special courses are higher. Students in the technological department who enter at the lower rate must be engaged in the industry which the class illustrates, or in one closely allied to it.

The courses provided in the various departments cover a very wide range of subjects. Provision is made for primary and intermediate instruction. A very thorough commercial course, extending over three years, is provided in the commercial evening school. The school of art provides instruction for both day and evening students in a great variety of subjects. The school of music offers thorough instruction in vocal and instrumental music. In the technological department are courses in chemistry, physics, and engineering, besides the more practical courses detailed further on.

There are also classes in commercial subjects for teachers, and special classes for females.

Outlines of several technical courses are as follows:

Iron and steel manufacture: The course begins with iron smelting and puddling, including composition, character, and treatment of iron ores, construction of furnaces, choice of fluxes, effect of blast, fuel, etc., varieties and properties of pig irons, characters of various wrought irons, etc. Bessemer and open-hearth processes are next taken up, and include such subjects as cupolas, converters, etc., theory of the acid and basic Bessemer blow and open-hearth heat, composition of materials and uses of spiegeleisen and ferro-manganese, calculations, steel testing, etc. The course is concluded with a consideration of crucible and shear steel and malleable iron

castings. Machine construction and drawing, theoretical mechanics, applied mechanics, inorganic chemistry, and metallurgy form part of the full course; and at least two of these subjects must be taken before a full technological certificate will be given.

Gas manufacture: Instruction in this course includes construction and setting of retorts and furnaces, effects of temperature upon production, laying of mains and pipes, construction of meters, description of various apparatus and instruments used in the manufacture and consumption of gas, description of tests, etc.

Candle manufacture: This course is included in a course on oils and fats. The entire course covers the various subjects relating to the chemical construction of fats and oils and the results of various chemical processes, the properties of paraffin, the mixing and refining of oils and waxes, the making and chemical preparation of wicks, construction of lamps, the molding of composite, stearin, and paraffin candles, determination of illuminating power, and other subjects of interest and value to the candle manufacturer.

Besides the above courses there are courses in plumbing, brickwork, masonry, carpentry and joinery, typography, and in flour manufacture, and a very complete course in mechanical engineering.

The special classes for females offer courses in dressmaking and millinery.

The school is governed by a general committee elected by members and subscribers. The teaching staff of the technical school consists of 22 instructors, most of whom are college graduates. During the year ending May, 1899, there were 880 students registered in the technical school, but only 53 took distinctively technical courses, the remainder being connected with some of the science classes.

The school building was completed in 1868, and cost £30,000 ($145,995). The institution is maintained from students' fees, grants from the science and art department, and from the West Riding and Leeds county councils, and from subscriptions and other sources.

Some years ago trade unions opposed a bookbinding class. To allay opposition only actual workers were admitted, but the opposition continued. After a year's trial of this plan, anyone was admitted, and that custom now prevails. The Association of Employing Plumbers aids the plumbing class.

Students leaving the school enter the shops as apprentices. They find ready employment and earn rapid promotion.

The industries of the community have been benefited by the school, and its work has been generally satisfactory.

MUNICIPAL TECHNICAL SCHOOL, LEICESTER.

After an existence of seven or eight years as a private school this school was taken in charge by the city in 1897, and a new building costing £4,000 ($19,466) was erected. The school was opened to day pupils in 1899.

The technical classes are intended primarily for learners engaged in the trades, but are open to any person residing in the borough of

Leicester or who is engaged in any business or attending any school in that borough. All students in these classes are expected to make at least twenty attendances, and to present themselves for the examination of the City and Guilds of London Institute or of the board of education. Students failing in either of these expectations will be charged higher fees than are charged those who comply with them. The fees in the technical classes range from 2s. 6d. to £1 10s. ($0.61 to $7.30) per session.

The evening classes are arranged in three sections, namely, technological, scientific, and commercial. The commercial section includes classes in French, German, shorthand, bookkeeping, and commercial correspondence and mathematics, and therefore does not concern this inquiry. The course of instruction in all the classes of the technological and scientific sections is so arranged that students may obtain a thoroughly scientific and technical knowledge of the work. Lectures accompanied by practical illustrations are given in the principles of the textile and boot and shoe industries, in electrical engineering, in wool dyeing and leather dyeing, in sanitary engineering and plumbing, in carpentry and joinery, wood carving, house painting, papering and decorating, in bookbinding and typography, and in dressmaking and millinery. The courses of instruction offered in these classes are briefly outlined as follows:

The course of instruction in textiles (framework knitting) follows the syllabus of the City and Guilds of London Institute. Students while attending the course of lectures in the ordinary grade are taught the rudiments of practical framework knitting by a series of lessons in the machine room, which is well equipped with machinery to illustrate the subjects taught. Lectures on various branches of the hosiery trade are given by experts from time to time. The day classes in this subject are intended for youths who are at present apprenticed or who will afterwards enter the hosiery trade. In this class the work is very much the same as in the evening class, only more attention is given to the explanation of the various machines used in the factory.

The work of the boot and shoe manufacture department is divided into three branches: Clicking and pattern cutting, machining and upper closing, and making and finishing. Students are allowed to complete any one or all the courses, but those who expect to take the City and Guilds examinations are advised to take all of them. Once a week there is held a class, in which various subjects connected with the industry are discussed and demonstrations given on new machinery. A system of local examinations has been formulated, and it is possible for a student to become a certified pattern cutter, clicker, laster, or finisher, as the case may be.

A course in theoretical wool dyeing, with practical illustrations, follows the syllabus of the City and Guilds of London Institute. Students

taking this course are expected to attend chemistry classes if they wish to make thorough progress. Supplementary to the above is a practical course in wool and leather dyeing. In this practical course special attention is given to leather dyeing. The dyehouse is open to day students two afternoons a week.

The course in carpentry and joinery comprises oral instruction, practical illustrations, and actual work in the shop. The course follows the syllabus of the City and Guilds examination.

The bread-making class is intended for journeymen bakers and others, and deals with such subjects as heat, fermentation, constituents of wheat, flour, etc., and the scientific principles underlying the production of bread.

The dressmaking course embraces theoretical and practical instruction in drafting, measuring, cutting, fitting, and making. The full course prepares students to earn a livelihood at the trade, and a number of former students are so doing. The course in millinery provides ample training in making and trimming ladies' hats, bonnets, and caps, neck finishes, fancy muffs, and children's hats and bonnets.

The courses in house painting, paper hanging, graining, and decorating, bookbinding, and typography follow the syllabuses of the City and Guilds of London Institute.

The school has experienced some difficulty in procuring good teachers, and has arrived at the conclusion that it must make its own. Successful teachers must come from the shops and be trained in the school, or else students must be prepared to teach by being sent into the shops to get experience. There are 25 instructors permanently attached to the school.

In 1900 there were 1,393 pupils in attendance on both the day and evening schools.

Former students enter the shops as apprentices. Master house painters have a clause in the indentures of apprentices requiring that they shall attend the trade school and the masters are responsible for the fees. Over 50 employing firms, including some of the largest in the town, have agreed to give preference, when selecting male employees, to those holding certificates from the school.

LIVERPOOL SCHOOL OF SCIENCE, TECHNOLOGY, AND ART, LIVERPOOL.

This is an institution devoted to science, technology, and art. Its curriculum offers courses of study in naval architecture, navigation, nautical astronomy, the building trades, engineering trades, metal-plate trades, printing and paper trades, miscellaneous trades (such as tailoring, millinery, watch and clock making, etc.), general subjects (such as mathematics, mechanics, chemistry, geology, physics, etc.), and special lectures and demonstrations on sanitary science.

There are 41 instructors and the classes are open from about the middle of September until the following May, there being a course of about 30 lessons in each class.

The classes in naval architecture, navigation, and nautical astronomy are arranged to be held at the nautical college under the management of the nautical instruction subcommittee of the city council, and in connection with the science and art department.

The classes are open to both sexes and a large list of prizes is awarded, at the discretion of the committee, to students who are successful at the examinations, provided they have attended at least 20 lectures during the year in the subjects for which they have entered. The committee desire that the prizes shall take the form most beneficial to the students, so those who obtain them have the option of choosing books on scientific, art, technological, or other subjects approved by the committee, or a part or the whole of the net value may be taken in instruments or tools, or devoted to the payment of class fees.

ST. BRIDE'S FOUNDATION INSTITUTE, BRIDE LANE, FLEET STREET, LONDON, E. C.

The Foundation was established in pursuance of a scheme framed in accordance with the city of London parochial charities act of 1883, and was approved by Queen Victoria in 1891. In 1897 the scheme was amended so as to provide for the administering of certain grants approved by the charity commissioners, and in the same year the constitution of the governing body was amended to conform with the technical instruction act of 1889.

While the institute performs various eleemosynary functions and provides excellent social and recreative departments, its primary object is to promote technical education for printers. It may, therefore, be called a technical printers' institute for compositors, machine minders, pressmen, and lithographic printers, and its design is to give such technical instruction as can not usually be obtained in a printing office. This instruction is not intended to be a substitute for the practical training of the office, but a supplement to it. The courses of instruction are arranged in accordance with the syllabuses of the City and Guilds of London Institute, and students are encouraged to compete for the prizes offered by that institute. Apprentices under 19 years of age are charged a fee of 2s. 6d. (61 cents) per year. Others are charged 5s. ($1.22).

The course for compositors is divided into three stages. The class in elementary instruction admits apprentices between 16 and 18 years of age, and the course deals with the underlying principles of the craft. The advanced class is open to compositors over 18 years of age, and the instruction is intended to afford students a good all-round journeyman's experience. The honors class is specially intended for

those who have obtained a certificate in the advanced section. The course is of a highly advanced character and is designed to meet the requirements of those who seek to qualify as managers, etc. Students in this class are afforded opportunities to visit paper mills, stereotypers, electrotypers, process block makers, etc. The theoretical instruction in all three of these classes is supplemented with ample shop practice in the institute's well-equipped printing office. In addition to the regular work in these courses, students are permitted to receive instruction in the linotype section without extra charge. This section provides theoretical and practical instruction in the principles of typesetting machinery.

The class for machine minders is intended to furnish instruction to those exclusively employed in the machine branch of the printing trade. Elementary instruction in the principles of the trade and suitable to apprentices 16 to 18 years of age is followed by an advanced course intended for apprentices and journeymen above 18 years of age or such as have passed the elementary examination. Considerable time is devoted to practical work.

The work of the lithographic school is divided into three stages. The elementary class is designed to give instruction in the fundamental principles of the craft and sufficient practical work to demonstrate the theory, at least half the time being devoted to practice. The course is open to apprentices from 16 to 18 years of age. The advanced class is open to those who have passed the elementary examination and to apprentices and journeymen over 18 years of age. The instruction is designed to cover the whole of the details of the ordinary journeyman's experience at press and machine and should be taken concurrently with science, chemistry, and machine construction and drawing. Practical work is given in conjunction with the theoretical work. The honors class is open to students who have secured certificates in the advanced grade, and it is prepared to offer instruction in the most intricate details of the craft, including the various photo-mechanical processes allied to lithography. It is intended that this class shall be for research, and students are at liberty to give one evening a week in carrying out their own experiments.

As has been stated, all the above classes are open to apprentices not less than 16 years of age actually engaged in trade. Apprentices under 16 years of age are advised to study arithmetic, English grammar and composition, geometrical and mechanical drawing, and chemistry at evening continuation schools, thus utilizing their time from 14 to 16 years of age for the study of subjects necessary before entering technical schools.

Students in all classes of the institute have available for their use the Passmore Edwards technical reference library, containing 2,189 volumes of works on printing, paper making, bookbinding, and the

allied trades; the Talbot Baines Reed collection, containing 2,060 volumes, mostly relating to printing, typefounding, etc., and the William Blades library, embracing a unique collection of books and pamphlets, numbering 3,631 works, relating to the art of printing, specimens of typography, etc. These collections are the property of the institute and contain the most nearly complete set of technical works upon typography and lithography in the United Kingdom.

The number of students attending the classes in 1900 was 139. Of these 96 took examinations and 77 passed. The ages of pupils ranged from 14 to 46 years, but most of them were from 20 to 32 years of age.

The present building was first occupied in 1894. It is well arranged, and its equipment is well adapted for the purposes of the school. The building and grounds cost £33,574 16s. 5d. ($163,392). Certain charity stocks were sold by the charity commissioners and part of the funds thus raised went toward paying for the building and the balance was converted into consols and India stock. The income from these latter investments is used in partial maintenance of the school.

Employers assist in increasing the usefulness of the school by allowing their apprentices to leave their work in time to attend classes from 5 to 7 p. m. Students leaving the school enter the shops as apprentices, but they rise rapidly in their trade as a result of their school training.

CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY, LEONARD STREET, CITY ROAD, LONDON, E. C.

The operations of the City and Guilds of London Institute are divided broadly into four branches, namely, City and Guilds Central Technical College for higher technical instruction in mechanics and mathematics, civil, mechanical, and electrical engineering, and chemistry; City and Guilds Technical College, Finsbury, for intermediate training; South London Technical Art School for classes in modeling, drawing and painting, house decoration, etc., and the technological examinations. A general description of the institute and a list of subjects upon which technological examinations are prepared has already been given on pages 993 to 996. A large number of technical and trade schools throughout the Kingdom arrange one or more of their courses in accordance with the syllabuses of the City and Guilds examinations. The central college and the art school do not come within the scope of this inquiry.

The operations of the City and Guilds Technical College, Finsbury, are divided into day classes and evening classes. The object of the day classes is to provide for the education of pupils who are desirous, before taking their places in factory, workshop, or studio, of receiving scientific training of a kind that will bear directly upon industrial production; of persons of either sex who wish to receive such a practical preparatory training in science or art as shall fit them hereafter to fill

intermediate posts, such as foremen or managers in industrial works; and of pupils who contemplate, after the completion of at least a two years' course at the college, entering upon the advanced scientific and technical courses of instruction, such as those at the Central Institution. These day classes therefore fulfill the functions of a finishing technical school for those entering industrial life at a comparatively early age; of a supplementary technical college for those who have had some industrial experience, and of an intermediate college in the educational scheme of the City and Guilds of London Institute. Day students entering the college are expected to take up the complete course in one of the several departments, but applications from persons wishing to attend only a part of the courses will be considered. The courses are laid out not to prepare the student to pass examinations, but solely to equip him with that knowledge which will best fit him to become a competent worker and thinker in the career he has chosen.

The object of the evening classes is to provide scientific and artistic education of a thoroughly practical kind for apprentices, journeymen, foremen, and others who are engaged during the daytime and who desire to receive supplementary instruction in the application of the principles of technical science and art to industries and manufactures. There is no compulsory course for evening students. They are free within certain limits to select those classes which will help them to make progress in their particular trade or business.

The college embraces departments of mechanical engineering and applied mathematics, electrical engineering and applied physics, industrial and technical chemistry, and applied art. The instruction in all the departments consists of lectures, class lessons, laboratory work, drawing office, and workshop practice. The courses in engineering extend over two years, and the chemistry course covers three years. Parts of these courses seem to be adapted to special trade instruction for students who are allowed to elect their classes. These parts of regular courses thus adapted are electrical-instrument making, coal-tar distillation, the practical processes of nickel plating, steel plating, electroplating, gilding, etc., cabinet making, pattern making, casting, metal work, enameling, and painting; and applied design in its relation to internal decorations, ironwork, gold and silver work, stone carving, wood carving, lace embroidery, pottery, and typographical ornamentation. Instruction in all these subjects is made thoroughly practical in laboratory, workshop, or drawing office practice.

Applicants for admission to the college must be not less than 14 years of age, and produce a certificate of good conduct from their former teacher, or other testimony of good character. In consequence of the demands of space for the laboratories and drawing office, preference is given, in filling up classes, to those who are actually employed in the respective industries and to those who have already attended a

preliminary course of instruction in one of the local polytechnic institutes or similar classes. In connection with each course of lectures in mechanics, electricity, heat, and chemistry there is a corresponding course in practice.

King Edward VII is president of the institute, and it is governed by a council which consists of 73 members.

The teaching staff consists of 26 instructors. In 1900 there were about 240 day pupils in mechanical engineering and between 800 and 1,000 night pupils in physics. There were 16 in cabinetmaking, 25 in chemical industries, and 327 in electricity. The ages of day pupils range mostly from 14 to 19 years. The evening students range from 14 to 50 years of age, and the majority of them are employed in shops or factories during the day.

Experimental classes were begun in 1879 and the college was opened in 1883. Its work has been constantly progressive and, upon the whole, eminently satisfactory.

BOROUGH POLYTECHNIC INSTITUTE, LONDON, S. E.

The progress of this school may be traced as follows: Institute opened September 30, 1892; opening of Herold's Institute and the purchase of the freehold from the city of London, 1893; opening of the bakery school and five workshops, 1894; opening of domestic economy school, 1894; reconstruction of Herold's Institute as a leather-tanning school, and opening of Norwood branch, 1895; opening of technical day school for boys, 1897; new school of cookery, physics laboratory, Victoria gymnasium, and five workshops opened in 1898.

Of the two branches mentioned above, one of them, Herold's Institute, is devoted entirely to leather tanning and dyeing, while the other, Norwood Technical Institute, includes in its courses classes in science and art, commercial and general subjects, and domestic economy for girls.

Technical and trade classes have been a strong feature of the institute's work from the beginning, and the governors have always been desirous of developing the industrial side of education as much as possible. The instruction given is both theoretical and practical, and is designed to supplement the experience of the factory workshops. Admission to the trade classes is restricted to those engaged in the trades, and students are not allowed to attend for practical work only. Apprentices and improvers under 19 years of age, on producing a letter from their employer or foreman, are admitted to any special trade class at half fees.

The regular courses in the builders', metal, engineering, and some other trades extend over three years. The first year's course is preliminary and general, and is the same for all the trades just mentioned. It includes practical mathematics from arithmetic to plane trigonometry, and technical, free-hand, and model drawing. The second and

third years cover the subjects of carpentry and joinery, bricklaying, plumbers' work, metal plate work, leather manufacture, and boot and shoe making. These courses are similar to courses in the same subjects described for preceding institutions and are not given in detail here.

A special department known as "The National School of Bakery and Confectionery" forms a very important part of the polytechnic work. It is supported by the National Association of Master Bakers and Confectioners, the London Master Bakers' Protection Society, and the Scottish Association of Master Bakers, and is managed by the governing body of the Polytechnic through an advisory committee appointed by the national association. The courses are very extended and thorough and are shown in detail. First are shown the day courses, which are as follows:

Bread section: Course A—The work of this course is shown in the syllabus appended to Course G of the evening courses below. The preparation work of each lesson is taken in the mornings; the practical work in the evenings.

Course B—Lectures and experimental work: Wheat, including germ, endosperm, and bran; atom, molecule, element, mixture, and compound, with illustrations; yeast; preparation of the wheat berry for milling; acid, base, alkali, and salt, with illustrations; microscopical examination of yeast; constituents of flour; thermometers; microscopical examination of starches; specific heat; organisms that produce fermentation; gluten; the microscope; starch gelatinization; review of previous lessons; gas evolving power of yeasts (compressed); drying of starch after washing from flour; ovens, firing, stoking, etc.; malt, composition, etc.; mineral constituents of flour; estimation of potassium and phosphoric acid; machine bakery management; specific gravity of worts; moisture and soluble extract in flour; saccharification of malt, etc.; cellulose and fat estimation (Soxhlett's method); estimations of sugars.

Course C—The morning work is marked *a*; the afternoon demonstrations *b*.

(*a*) Ferments; (*b*) ferment sponge and dough; (*a*) advantages and use of sponges; (*b*) sponge and dough; (*a*) ripeness of dough; (*b*) ferment dough; (*a*) weak and strong doughs; (*b*) off-hand dough conducted over a period of twelve hours; (*a*) patent yeast; (*b*) ferment sponge and dough from patent yeast; (*a*) specific gravity of worts; (*b*) ferment dough (patent yeast); (*a*) Scotch-flour barm; (*b*) Scotch-flour barm (half-sponge process); (*a*) salt in bread making; (*b*) Scotch-flour barm (quarter-sponge process); (*a*) texture and pile of bread; (*b*) modern processes of Scotch bread making; (*a*) brewers' yeast; (*b*) ferment sponge and dough from liquid bread yeast; (*a*) hard and soft water, their action; (*b*) ferment and dough (liquid brewers' yeast); (*a*) different flavors in bread; (*b*) sponge and dough (liquid brewers' yeast); (*a*) compressed yeasts; (*b*) ferment and dough (compressed yeast); (*a*) holes in bread; (*b*) sponges and dough from compressed yeast; (*a*) sour bread; (*b*) off-hand dough (compressed yeast); (*a*) ropy bread; (*b*) review of the work of the course; (*a*) spontaneous fermentation; (*b*) leavened bread; (*a*) Hungarian flour; (*b*) Vienna bread; (*a*) flours resembling Hungarian; (*b*) Vienna bread from such flours; (*a*) whole meal; (*b*) whole-meal bread; (*a*) action of an acid and soda upon each other; (*b*) whole-meal bread with chemicals for aëration; (*a*) germ and other varieties of meal; (*b*) manufacture of bread from these; (*a*) potatoes in bread making; (*b*) ferment and dough with potatoes as yeast food; (*a*) scalded flour as yeast food; (*b*) ferment and dough with scalded flour as yeast food; (*a*) malt extracts, their value in bread making; (*b*) ferment and dough with malt extract as yeast food; (*a*) diastase in bread making; (*b*) ferment and dough with diastase as yeast food.

Confectionery section: Course D—The articles are taken consecutively: Puff paste; rock and rice; puff paste (French); Bath buns; sultanas; bouchées de dames; Genoa goods; lobster patties; tarts; fancy gateaux cases; light genois; babas and saverins; vol-au-vent; butter biscuits; veal and ham patties; sausage rolls; sultana cake; plain buns; cake; French puff paste; tennis cakes; plain patties; cream tarts; mince-meat; Christmas pudding; mince pies; plain buns; sultana buns; madeleines; sultana scones; Bath buns; artichokes; seed cake; oyster or chicken patties; cheese cake; hazelnut cake; heavy Genoa; petit four glacé; Scotch buns; cocoanut biscuits; currant cake; sultana and other scones; Madeira cake; torte de vienois; cocoanut cake; wedding cake; almond icing; light genois; light genois into raspberry cakes.

Course E—The articles are taken consecutively: Wine biscuits; macaroons; sponge cake; pompadours; fondant; dessert—sweets; ginger nuts; fancy biscuits; Scotch shortbread; gâteaux St. Hónoré and mocha; small nougat cases; French fancy biscuits; marzipan mixture and Hill's process; fancy meringues; sugar boiling; entremets aux crême; large nougat cases; route biscuits; chemistry of sugar; finish route; tipsy cake; langue de chat; petit Madeleine; whole-meal biscuits; cocoanut macaroons; Savoy biscuits; almond dessert; chocolate fondant; dattes diamants; ratifias; haricottes biscuits; hollandaise biscuits; gingerbread; small meringues; nougat cases, small; petit four sec à la poche; marzipan fruits; biscuit à la reine; mascottes aux chocolat; entremets with cream; preserving of pineapples; chemistry of butter; seed and Genoa block; small almond dessert.

Course F—Advanced work, mornings, 10 till 1. The rest of the work is Course M below: Marzipan work, roses, etc.; decorating of cakes with fruit; ices, strawberry cream; preserve of fruit pulps; clear jellies stock; maraschino jellies, decorated; lemon water ice; fancy ices, dessert fruit and flower; souflées de noisettes, large; creams, strawberry or maraschino; marzipan cake; ices, their different degrees and amalgamation; decoration of trocaderos cakes with fruit; writing of inscriptions; writing on chocolate tablets for birthday cakes; piping of cake tops, "dummies;" kirsch jelly; tangerin ice; ice "bomb's;" strawberry souflées; modeling of fruits in marzipan; decorating of birthday cakes with fruit; chemistry of sugar; ice sorbet.

The session for evening students opens on Monday, September 25, and ends with the examinations in bread making. The evening courses are as follows:

Bread Section: Course G—Practical course, taken both by day and evening students. The seven phases in the life of a loaf; off-hand dough, demonstrating the former lecture, conducted over a long, a medium, and a short period of time; off-hand dough, conducted on the same lines, with potatoes, malt extract, scalded flour, sugar, and diastase as yeast food; off-hand dough made with an excessive quantity of yeast; visits to a yeast factory, a mill, a machine bakery, a cake and biscuit factory, and two machine works; Vienna bread; off-hand dough, with average quantity of yeast and high temperature; brown and other varieties of meal bread with yeast and chemicals as aerating agents; off-hand dough, conducted over the shortest time possible; general review of results and conclusions.

Course H—Advanced theoretical course. The wheat berry, with lantern demonstrations, etc., including symbols, formulæ, etc.; yeast; milling; fermentation; yeast growth; flour; heat; gluten from various flours; microscopical instruction; saccharification of starch, etc.; gas evolving power of brewers', patent, and distillers' yeasts; maize starch in breadmaking; ovens; malt extract in breadmaking; time and heat in relation to breadmaking; machinery and belting; experiments on yeast growth; acidity in bread or flour; diastasic capacity of malt extract, by Litner's method; gluten estimation, etc.; bakehouse management.

Course J—Practical course. The syllabus of this course is that of Course B of the day courses.

Confectionery section: Course K—Eclairs and choux; plain madeira; rice cake; Scotch madeira; light chocolate and hazelnut cakes; Dundee cake; meringues; Russian cakes; Genoa for fancy goods; Christmas cakes; Madeleine, large; plain and seed block cake; puff paste; rich currant cake; light genois for gâteaux; butter biscuits; Chutz biscuits; sponge mixture for fancy goods; Victoria sandwiches and pommes de terre; warm meringues mixture; sugar boiling; mince meat.

Course L—Meringues; marzipan; fondant; caramel dessert; route biscuits; fancy gâteaux (French); sugar spinning; dessert—sweets; trifle; pineapples, and how to preserve them; finish genois; finish Christmas cake; small almond dessert; sultana scones; Edinburgh cake; cherry cake; cocoanut block cake; ice and decocate tennis cake; Christmas pudding; finish mixture; entremets charlotte russe; ices; fancy biscuits; Savoy biscuits.

Course M—The course is in piping only, elementary and advanced, and for all students, day and evening. Icing sugar; piping general; piping cake tops and sides of cake; how to ice cakes proper; piping dummies and chocolate tablets; decorating birthday cakes; piping wedding cakes; piping sugar roses; ice and pipe dummies; inscriptions on cake tops; piping birthday cakes, wedding cakes; Christmas cakes, and bride cake.

There are classes for ladies' tailors and dressmakers in the school which are intended primarily for professional dressmakers, but apprentices are admitted at half fees on a letter from their employers. The course is divided into three sections and covers very fully the whole subject of the trade.

Besides the classes already enumerated there are courses more or less extended in pattern making, men's tailoring, letterpress printing, bookbinding, wood carving, wheelwrighting, and cart building, and a number of general and domestic subjects.

The teachers are actual craftsmen. They conduct lectures one night and trade classes the next. Practical training is regarded as a vital necessity for an instructor. Even a teacher of chemistry must have practical knowledge of its application to some trade. The annual enrollment has steadily increased until more than 2,000 men and nearly 1,000 women paid admission fees in 1897–98.

The school has increased the general intelligence and efficiency of the working classes. Its pupils are saved two years of drudgery in workshops if they enter the Polytechnic direct from the elementary schools, and they go into the shops prepared to complete their apprenticeship by the time they are 21 years old. The school has been the means of improving shop training, and employers in some instances recognize the worth of the school by giving prizes. At first labor unions opposed the school, but that opposition has disappeared. Altogether the work of the school has been satisfactory.

BOLT COURT TECHNICAL SCHOOL, 6 BOLT COURT, FLEET STREET, LONDON, E. C.

This school was founded by the National Society of Lithographic Artists, and was at first aided by the technical education board and the county council. Later the board and council took entire charge and it thus became a municipal institution.

The object of the school is to give instruction in producing surfaces for printing. Of the various classes held some are concerned with the more artistic side of the work, others with the technical, but there is no real line of demarcation between the two, either in intention or practice, the division being made solely for convenience of teaching. Instruction is given in drawing, design, lettering, lithography, elementary photography, photographic copying, and the chief photo-mechanical processes. The school is open to those who are engaged in any branch of the trade, but no provision whatever is made for amateurs. The technical education board considers applications from parents who intend placing their sons as apprentices, but such students must be duly apprenticed within some arranged period of time. The practical instruction is not intended to replace work-shop training but is preparatory or supplementary to it, and has for its object the giving to those engaged in one department of a craft a knowledge of allied branches which in the ordinary course of the trade they can not obtain.

The fees for day students are £9 ($43.80) a year, and for evening students 7s. 6d. ($1.83) per term; but in cases of students whose weekly income does not exceed 30s. ($7.30) this fee is reduced to 3s. (73 cents) per term. Each school year comprises three terms. There are 160 competitive art scholarships, ranging in value from £5 to £20 ($24.33 to $97.33), and free tuition for from two to three years.

The full course of instruction may be divided under three general heads, namely, drawing, technical art, and process work. The work in the drawing class includes drawing and painting from figure and from costume model, drawing and painting in color from natural forms, draperies, etc., and drawing and painting from the antique and casts from life and natural objects, such as flowers, plants, birds, etc. The technical art classes have instruction in design as it relates to the ornamentation of surfaces, and special attention is given to book decoration, such as lettering, type, and various kinds of work required in the printing trade. The class in lithography is instructed in drawing on polished stone (pen work), on grained stone (chalk work), on transfer and other papers, and on zinc and aluminum; lithography in color; combinations of lithography with process work, as collotype and half-tone, and instruction in the use of Day's shading media.

The classes in process work begin with negative making, which deals with the production of negatives and positives required for the various photo-mechanical processes, and also for the production of pictures, etc., by the usual photographic printing methods. Beginners receive instruction in the technology and practice of ordinary negative making and silver printing; they are then advanced to line and continuous tone negative making, screen negative making, and tricolor block making. Then are taken up in order ordinary color

photography and measurement and half tone process work and the scientific application of the same. Following negative making the various printing processes are taken up, beginning with line and tone blocks on zinc and followed in succession by instruction in enameline or "fish glue" in its application to half-tone blocks in zinc, copper and brass; fine etching; collotype, and photolithography in line and tone.

The school has experienced some difficulty in securing good teachers from ordinary sources, and all of the instructors are taken from shops. In 1898–99 there were 243 students, of whom 201 were in evening classes. Of the 42 day students, 28 were in the art department only, and 14 were taking photo-process work. The ages of students range from 14 to 56 years, though most of them are from 20 to 28 years of age.

The school is well equipped with the necessary appliances for study and practical work. The art studios are well arranged and well lighted, and the photographic and printing rooms are fitted with all modern requirements.

While the school was founded by a trade union, there was at one time strong prejudice against any trade school or trade paper revealing the then secret processes of photography. This has partially disappeared. Former students are required to serve as apprentices, but they command ready employment and advance rapidly in their trade. The industry which the school was intended to help has been benefited and the work of the institution has proved entirely satisfactory.

BATTERSEA POLYTECHNIC, BATTERSEA PARK ROAD, LONDON, S.W.

This institution is an outcome of the work of the South London polytechnic committee, and is designed to provide technical, scientific, and general education for the inhabitants of this and neighboring districts. The foundation stone was laid in 1891 and the buildings were formally opened in 1894. The buildings and equipment cost £80,000 ($389,329). The school has a fixed annual endowment of £3,500 ($17,033) from the City Parochial Foundation, and the London Technical Education Board also contributes annually about the same amount.

Membership of the institute is open to any student, male or female, between the ages of 16 and 25 years, upon payment of a registration fee of 1s. (24 cents) and a subscription of 6s. ($1.46) per year for men and of 3s. (73 cents) per year for women. A few students above the age of 25 are admitted by the governing body upon the same terms as noted above for men. The day school is open to those preparing to enter the ordinary apprenticeships and to those already

apprenticed, if they can be absent from their employment for one or more half days weekly. The principal work of the institute, however, is the provision of evening classes in all subjects of technology, science, art, commerce, domestic economy, and music.

While the courses of study are largely elective, students who can attend several sessions are strongly advised to undertake a progressive and properly connected course ranging over two, three, or more years. Trade students are impressed with the importance of having some knowledge of the sciences underlying their trade if they desire a thoroughly sound trade education.

Some of the more important trade courses are shown in some detail on the following pages. These classes are open only to persons actually working in the trades. Students may take the lecture courses without joining the workshop classes, but all who enter the shop classes must also take the lecture courses.

Fitting and machine shop: All students in this subject must attend a class in drawing, mensuration, or some other kindred subject, unless specially exempted. The course includes, besides drawing, lectures upon such lines as the various needs of students may require, and practical shop work according to their needs. Instruction is, as far as possible, individual. The shop is provided with lathes, drilling, planing, shaping, and milling machines, so that engineering students and others may receive instruction in the working of all ordinary machine tools.

Smith's work: This course is very much the same as that for machinists, except that forge work takes the place of machine-tool work.

Drawing and plate work: These classes are specially intended to meet the requirements of the marker off, plater, angle smith, and metal-plate worker. The work is thoroughly practical and is directly applicable to the setting out of all plates in the construction of various steam boilers, and for the development of uptakes, smoke boxes, funnels, ventilators, hoods, etc. The student is required to make working drawings and then make models in the steel-plate workshop.

Cycle construction: Half the time allotted to this course is devoted to lectures, drawing and testing, and half to workshop practice. The lectures cover elementary mechanical principles applicable to cycle construction, qualities and treatment of materials for cycle purposes, types of frames, strength of tubes, compression, tension, torsion, bending, shearing, strength and weakness of frames, springs, wheels, bearings, tires, and cycle details in general. Drawing includes geometry, circles, polygons, cone and sections, frames, wheels, hubs, pedals, chains, gear wheels, bevel gear, and all other parts, besides designing. The class is provided with a testing machine fitted with exact measuring arrangements for testing all cycle parts under practical conditions. Practical shopwork includes turning, fitting, screw cutting, building wheels, setting up frames, milling cranks, brazing, forging, hardening, and tempering, and all the other operations necessary in making a cycle.

Pattern making: The work of this class comprises the setting out and making of patterns under the direction of the instructor, and includes lessons on timber and tools used, rules for contraction, ring segments, jointing, doweling, pegging, rapping plates, lifting straps, use of hollows in castings, use of prints, core boxes, core boards, core templates, and other work relating to general engineering patterns. Regular courses of work are arranged for beginners and apprentices, and as far as possible the work done is adapted to the individual requirements of students, who may, if they desire, mold their own work in the foundry, thus gaining a thorough insight into their work. Students are required to attend drawing classes, unless they

already possess sufficient knowledge of the subject to be able to make and read working drawings.

Carpentry and joinery: This course is arranged to extend over three years, but if a student can pass the examinations in a shorter time he is permitted to do so. The lecture courses afford complete instruction in carpentry and joinery, and the work is arranged to suit the requirements of individual students. Students in this course are recommended to take up geometry, applied mechanics, building construction, and builders' mensuration.

Staircasing and hand railing: The work done in the course includes proportions of treads and rises, landings, heights for rails over flyers and landings, methods of setting out and gluing up strings, etc., finding face molds and bevels by square-cut system of hand railing, marking out and squaring up wreaths, scrolls, etc., and designing stairs, rails, and balusters. A good knowledge of practical plane and solid geometry is essential to successful work in the classes.

Brickwork: The full course covers two years. Students are first grounded in the technique of the trade by a series of lectures including the following subjects: First year—Technical drawing from sketches and specially prepared diagrams; the meaning of plan and elevation; various kinds of bonding; bond at acute and obtuse angles; walls and foundations; prevention of damp in walls; brick walls with stone facings; hollow walls, and window and door openings in same; fireplaces, coppers, and ovens, and arrangement and method of building smoke flues; arches, and bonding of same; patent and ornamental tiling; roof tiling; tile paving, etc.; the various kinds of pointing; materials used by the bricklayer, limes, cements, concrete, bricks, sand, mortar, etc., their nature, properties, and characteristics; method of measuring bricklayers' work; sanitary work, method of laying drain pipes. Second year—Technical drawing, in the more advanced subjects; circular and octagonal bays, niches, domes, etc.; tunneling, vaulting, etc.; shoring and underpinning; intricate bonding in ordinary and gauged work; terra cotta, and its application to buildings; sanitary science as applicable to bricklayers' work; specifications of bricklayers' work; management of works; a general outline of the orders and styles of architecture. Practical shop work the first year includes instruction in gauged work, squaring of bricks, striking, cutting, and setting the various forms of arches; molded work; demonstration of bond, and examples of ornamental brickwork and pointing. The second year embraces advanced gauged work and ornamental brickwork. No student is allowed to begin practical work until he has passed a satisfactory examination on the lecture subjects.

Masons' work: These classes are intended for apprentices and artisans engaged in masons' work. The instruction is thoroughly practical, and includes the application of descriptive geometry to masons' work, the making of working drawings, and setting out and executing the work in stone. Lectures covering every phase of the trade are given on one evening each week. Among the subjects embraced are setting out; squaring; jointing; bonding; setting out columns, pilasters, arches, niches, and doorways; setting out twisted stair work; vaultings, oriels; molding, skew arch, stone turning, etc. Students are also recommended to join classes in practical geometry, building construction, and builders' mensuration.

Plumbers' work: This course is intended to take students just commencing the subject and carry them systematically through the various stages of the trade. Besides shop practice, including full instruction in lead bossing, pipe bending, lead laying, rolls and seams, wiping of joints, setting out work, etc., there is also a thorough lecture course covering the subjects of general sanitary arrangements and appliances for building drains, traps, baths, lavatories, sinks, water-closets, earth closets; ventilation; measuring and estimating work; methods of testing soil pipes, drains, etc.; setting out work and making working drawings; methods of water supply,

prevention of pollution; filters; cisterns; connection between disease and water, etc.; weight, pressure, velocity, and discharge of water under different conditions; cocks, valves, pumps, rams, turbines, etc.; properties and manufactures of the various metals and alloys used in plumbing; action upon metals of air, water, acids, sewage gases, etc.; disposal of sewage; solders and fluxes; roofing, hot-water fitting, gas fitting, etc. Applied mechanics and building construction are recommended as supplementary work.

Plasterers' work: The course of instruction is thoroughly practical and includes short lessons on the composition, properties, and manufacture of the various materials used in the trade, together with practical work on building shop plastering. Some of the subjects covered are carton pierre, papier-maché, casting and pressing in sand and Portland cement, setting out ceilings, running ovals, fluted columns, and stucco-work. Students are urged to join classes in the art department also. To obtain a full certificate students must pass examinations in free-hand drawing, model drawing, and modeling.

Tailor cutting: Classes have been formed to provide instruction for men engaged in the various branches of the tailoring trade in cutting out all kinds of tailor-made garments. The lessons are thoroughly practical, and instruction is given in the making of different garments.

There is a thorough technical and practical course in photography, covering every detail of the art from the simplest amateur work to the most complicated color photography. The school is equipped with every modern facility for giving the most satisfactory practical training.

A women's department is devoted to trade instruction for women. A special course in cookery offers a thorough training in plain and fancy cooking, fitting students to enter successfully upon the duties of domestic cooks. Classes in professional dressmaking are arranged to cover all the requirements of the dressmaker's trade. There is also given a full course in millinery, adapted to teachers and persons wishing special trade instruction. Short courses in home dressmaking, laundry, and other domestic subjects are arranged to meet the every-day needs of housewives.

Engineering and chemistry occupy prominent places in the institute and thorough instruction is given in these subjects. The courses are laid out to meet the practical demands of students who expect to apply their knowledge to some particular line of work. Mathematics, physics, natural science, art, language, commercial subjects, and many other general subjects receive ample attention in the school. Altogether there are about one hundred regular and special courses in all departments.

The faculty is made up of an ample number of specially qualified instructors. All the practical instructors formerly held positions as foremen in shops. There are about 3,800 students in the evening classes, though some of them attend only a few weeks, and about 500 attend the day classes. More than one-third of all the students are entered in the mechanical engineering and building trades departments.

The school occupies a splendid and commodious building equipped

with all the necessary appliances for conducting strictly high-class work.

General benefits have come to the industries of the community. The working masses have become more intelligent and efficient, and students find ready employment as apprentices and rise rapidly in their trades. Many employers show their interest in the school by offering scholarships and prizes. This is notably true of those engaged in building and in ironwork.

SOUTHWESTERN POLYTECHNIC, MANRESA ROAD, CHELSEA, LONDON, S. W.

This institution was built and equipped at a cost of more than £60,000 ($291,990), the greater portion of which was raised by voluntary subscription. It at present possesses a fixed annual endowment of £2,500 ($12,166) from the charity commissioners, and the London County Council will also contribute an annual sum, which is expected to average about £4,300 ($20,926).

The institution is directed by a governing body consisting of representatives of the city parochial charities, the London County Council, the London school board, and the Chelsea vestry. The building is lighted throughout by electricity and provided with well-equipped mechanical, electrical, physical, chemical, and biological laboratories, with art and photographic studios, and with workshops. It is also fitted for schools of cookery, laundry work, needlework, millinery, and dressmaking, and possesses a large gymnasium furnished with all the most recent appliances. The teaching is conducted by the principal and 78 lecturers, demonstrators, and instructors.

The school is divided into a day college for men, a day college for women, a day school for girls and boys, and evening classes.

The day college for men is intended for students above the age of 15 years, and was in 1898-99 attended by more than 100 pupils, whose ages ranged from 15 to 40 years. It offers courses of study in mechanical and civil engineering, electrical engineering, and applied physics, chemistry, science, art, music, and commercial subjects covering broadly the essentials of a liberal business and commercial education. Such fundamental branches as mathematics, history, and English are prominent in the commercial department.

The scheme of the technical department is almost precisely that of the technical college at Finsbury, and may, with slight modifications, be well described in the words of Sir Philip Magnus in his inaugural address at that institution:

> Students who enter the college should have previously received a sound English education and have acquired an elementary knowledge of mathematics, physics, and chemistry. * * * The courses of instruction are arranged to occupy at least two years. On entering, the student will state whether he wishes to be trained as a mechanical

engineer or an electrical engineer, whether he wishes to be educated with a view to some branch of chemical industry or of the building trade, or, finally, whether he desires to study applied art. In any of these cases, except the last, he will find mapped out for him a complete course of study, involving laboratory instruction, tutorial work, attendance at lectures, exercises in mathematics, mechanical and free-hand drawing, and instruction in the workshops.

Students having completed a two years' course in the technical department of the college should be in a position to obtain situations in important industrial firms, or to enter upon advanced scientific and technical courses of instruction.

The day college for women is the counterpart of the day college for men. It is intended for students of 15 years and upward, and during the session 1898–99 was attended by 230 students. It comprises departments of commerce and physical culture and a general department. The commercial and general departments are composed of the same sections as the corresponding departments in the college for men, with the exception that domestic economy is introduced in the general department. The physical-culture department contains sections in gymnastic training for teachers and physical exercises.

Under the head of domestic economy instruction is given in cookery, dress cutting and making, laundry work, millinery, and sick nursing.

The school for boys and girls is intended for youths whose school education will continue until about the age of 16 years, and who desire training for the workshop, manufactory, building trades, or commerce. The school provides a progressive course in applied science, combined with workshop and laboratory practice, and in general and commercial subjects. The complete course extends over a period of four years, and includes an elementary, advanced, and advanced technical course.

The subjects of instruction for boys in the first and second years are mathematics, practical geometry, free-hand and other drawing, chemistry, physics, mechanics, English subjects, French, German, or Latin, and manual training and gymnastics.

In the third and fourth years boys may devote their attention to that group of subjects which has application to their future work, such as mechanical engineering, electrical engineering, civil engineering, building trades, chemical trades, commerce, or preparation for one of the various professional preliminary examinations—for example, matriculation at the University of London.

The subjects of instruction for girls in the first and second years are mathematics, practical geometry, free-hand and other drawing, chemistry, physiology and hygiene or physics, English subjects, French, German, or Latin, cookery, needlework and dressmaking, and gymnastics.

In the third and fourth years they are allowed to follow special courses of study which will fit them to become teachers of art, science, and domestic subjects, or to occupy positions in one of the many branches of commercial life now open to women.

The objects of the evening classes are (1) to offer to artisans and others engaged in technical and commercial industries the means of instruction in applied science and art, and similarly to women opportunities of training in cookery, dressmaking, and household management; (2) to offer instruction which will be of service to those intending to enter on a colonial life; (3) to give instruction in such other branches and subjects of art, science, commerce, language, literature, and general knowledge as may be approved by the governing body, and (4) to offer to its students abundant means of recreative instruction, recreation, and physical training.

The classes and lectures are designed and arranged to supplement, and not to supersede, the training of the workshop. The general scheme of the evening classes offers instruction in practically the same subjects covered by the day classes, and in addition thereto provision is made for instruction in the building trades and domestic economy.

Under the head of electrical engineering special advanced and elementary courses of lectures, each followed by practical instruction in the laboratories, workshops, and testing room, are given from October to May. These courses are well adapted to meet the requirements of electrical engineers who are desirous of qualifying for posts in electricity supply works or traction stations, of mining engineers, and others who have to deal practically with electricity, and those who are engaged in the electrical trades. They are also suitable for students taking the preliminary, ordinary, and honors grades examinations of the City and Guilds Institute in electric lighting and power distribution and for the evening science exhibitions in electrical engineering offered by the technical education board.

The work in the several classes of mechanical engineering is arranged to include the syllabus of the City and Guilds of London examinations in technical engineering, applied mechanics, steam and machine construction, and drawing.

EAST LONDON TECHNICAL COLLEGE, PEOPLE'S PALACE, MILE END ROAD, LONDON, E.

In 1882 the trustees of the Beaumont Philosophical Institution, in order to extend their work, took counsel with the Drapers' Company, and, as a consequence, a large hall, called the Queen's Hall, suitable for concerts and other entertainments, was opened in 1887. The Drapers' Company voted £20,000 ($97,330) from their corporate funds to erect suitable buildings for a technical school, and the foundation stone was laid on the same day that Queen's Hall was opened. In

1892 the Drapers' Company offered an annual contribution of £7,000 ($34,066) to the People's Palace, and the charity commissioners drew up a new scheme which provided an annual grant of £3,500 ($17,033) from the city parochial charities fund. In the meantime the Drapers' Company had made an annual grant of £1,000 ($4,867) for scholarships, and in 1893 the new scheme went into effect. The next year (1894) the company voted £5,000 ($24,333) for the erection of a separate building for an engineering laboratory and workshop. In 1898 the scheme was modified so as to allow of the amalgamation of the Bow and Bromley Institute with the People's Palace. The work of the college is now conducted in buildings adjoining the People's Palace, specially erected for the purpose.

The college is divided into three parts, the day school, the day classes, and the evening classes.

The object of the day school is to prepare boys between 12 and 16 years of age, by instruction in science, art, languages, and the use of tools, to enter a trade or profession demanding scientific or artistic training and manual dexterity. The full course extends over three years, and while its object is, as stated, to prepare for a trade, the the scope of the work is little more than manual training, no particular trade being aimed at.

The day classes are intended for both boys and girls who are over 15 years of age. Courses of instruction are arranged in engineering, chemistry, art, and in preparation for the bachelor of science degree of the University of London. Every student is expected to take the full course, except under special circumstances. The engineering course covers two years and embraces geometry, machine drawing and design, applied mechanics, steam, gas, oil, and heat engines, forms of steam boilers and details of their construction, experimental work, and practical shopwork. The course in chemistry extends over three years and is very thorough and practical. The bachelor of science course includes physics and an extended drill in pure and applied mathematics.

Besides courses in engineering, science, physics, and fine art, there are a number of trade courses conducted in the evening classes. In these trade courses People's Palace trade certificates are awarded in engineering, dressmaking, sign writing and graining, tailors' cutting, millinery, wood carving, and instrument making.

There is a lecture course in carpentry and joinery on the lines of the City and Guilds of London syllabus in carpentry. Besides these lectures there are exercises in drawing and setting out, and practical shop training, in which students are taught to work from detailed drawings. Only persons engaged in the trade are admitted to the workshop. The fee is 10s. ($2.43) per session.

In the plumbing course those portions of the various science subjects with which the trade is connected are studied and explained, and

the principles and practice of plumbers' work are fully illustrated by diagrams, lantern slides, and models. Those students showing sufficient knowledge of the trade will find arrangements whereby they may enter for the examination held by the Worshipful Company of Plumbers. An advanced pass in this examination entitles the student to become a registered plumber, and an honors pass entitles him to registration and honorary freedom of the Worshipful Company of Plumbers. Only those engaged in the trade are admitted to the classes. The fee for the whole course is 12s. 6d. ($3.04).

A course in scientific instrument making comprises all the latest methods in use, such as turning, chasing, milling, nurling, profiling, cuttering, working from templates, and the system of gauging and interchangeability, the use of the slide rest, etc., and finishing work, such as polishing, bronzing, lacquering, etc. Special attention is given to the making of electrical apparatus of various kinds. The fee is 10s. ($2.43) per session.

In tailors' cutting there are two classes—elementary and advanced. The teaching in the elementary course is individual as far as possible, and the instruction is practical and as simple as the subject will permit. The course deals with trousers, breeches, riding trousers, knickers, waistcoats, and jackets. Only those engaged in the trade are admitted. Only those who have passed through the elementary class or have a good knowledge of the trade are admitted to the advanced class. The instruction embraces work on morning coats, frock coats, dress clothes, and overcoats in various styles. The fee for the elementary course is 7s. 6d. ($1.83) and for the advanced course 10s. ($2.43) per term.

A course in bookbinding is provided for persons engaged in the trade. The whole subject is thoroughly taught, beginning with forwarding, taking up paper and book sizes, signatures, folding and collating, pulling books to pieces and refolding, guarding and folding plates, sewing and overcasting, inboard and outboard forwarding, covering in cloth and leather, half and whole bound work, siding and pasting down, in the order named. The advanced work covers cleaning and restoring, print inlaying, map and photograph mounting, head banding, india-rubber work, graining, leather staining, sprinkling, book-edge gilding, and marbling calf. The instruction in finishing embraces the elementary use of tools, various styles of half-bound work, the classic styles, line and gauge work, and design as applied to book-cover decoration.

The course in house decoration includes instruction in compounding and mixing of oil, paint, and distemper colors, and the practical knowledge of the same; harmony of color and effect for general purposes of house decoration, and the higher stages of decorative art, including stenciling, lining, arabesque and ornamental painting. The fee for the course is 5s. ($1.22).

Instruction in sign writing and graining embraces different styles of ornamental lettering, gilding, shading, etc., and graining in imitation of woods and marbles. The fee is 5s. ($1.22). The fee for these last two courses combined is 7s. 6d. ($1.83).

In dressmaking and dress cutting the course is divided into elementary, intermediate, and advanced work. The elementary work covers tacking bodice, sleeve, and skirt measures; drawing and cutting out; tacking calico patterns, and the sewing machine. Intermediate instruction embraces fitting; preparing corrected patterns for use in cutting out dress material; drawing, cutting out, and making skirts; working button holes, and making circular, flap, and welt pockets for jackets. Advanced instruction is given in making and boning bodices in dressmakers' and tailors' styles; making sleeves; shrinking and stretching seams, etc.; padding, and making collars and revers; making jackets, capes, etc., and French pattern modeling. The fee for the entire course is 17s. 6d. ($4.26) per term.

The course in millinery includes hat and bonnet making, making lace caps; hat and bonnet trimming; flower and feather mounting, and infants' and children's millinery of different kinds.

Besides the subjects already enumerated there are classes in modern languages, and short courses in such commercial subjects as shorthand, arithmetic, and bookkeeping.

The teaching staff for the entire college numbers about 80. There are (1901) about 400 boys in the advanced day classes, but few of whom take trade instruction; the evening engineering classes have about 100 students, mostly apprentices with engineering firms. There are about 60 in the carpentry class, 12 in brass work, 50 in plumbing, 35 in sign writing, and 50 in tailors' cutting. The college is supported from endowments, numerous grants for scholarships, and tuition fees.

The general benefits coming to the community are attested by the growing attendance upon the school. Almost every engineering workshop and drawing office in the East End has one or more boys from the school. Employers show a decided preference for former students, and the principal can generally obtain their admission into workshops as apprentices without payment of the usual fee of from £20 to £30 ($97.33 to $146).

CENTRAL SCHOOL OF ARTS AND CRAFTS, 316 REGENT STREET, LONDON, W.

This school was established by the technical education board of the London County Council, and was opened in November, 1896. The special object of the institution is to encourage the industrial application of decorative design and to give students every opportunity to study it in relation to their own particular craft. It is not intended that the school shall supplant apprenticeship, but rather supplement

it by enabling students to learn those things which they are unable to learn in the shop. Apprentices, learners, and improvers under the age of 21 are admitted to all the privileges of the school except the life class free of charge. Journeymen and improvers working at a trade or craft and receiving wages not exceeding 30 shillings ($7.30) a week may join the school on payment of 1 shilling (24 cents) a month. Others are admitted (except to the life class) on a fee of half a crown (61 cents) a month. Members of the life class are charged a fee of a crown and a half ($1.82) per month.

Instruction is offered in the following practical courses:

Architecture: This subject is treated by lecture and otherwise, as circumstances may suggest. The idea is that architecture should respond to the facts of modern life. Instruction is given in design, shaded drawing, stonework for architects, and leadwork in ornamentation. This last subject is treated broadly and can be followed to advantage by sanitary plumbers.

Stained-glass work: In this class is taught the theory of the general composition and setting of windows; the principles of cutting and use of the lead line in plain glazing; elementary principles of ornamentation, and the various treatments of the glass in painting. Practical exercises are afforded in painting glass from cartoons, sketching to scale, cutting and leading in so far as they influence design, and design.

Woodwork and metal-work design: This class is offered instruction in designing for furniture; decoration of furniture and joinery; ironwork, brass, copper, silverwork, etc. The subjects are treated chiefly by individual instruction, and students are advised to base their designs upon craftsmanship and understanding of material.

Silversmiths', goldsmiths', and jewelers' work: This is one of the most important departments of the school. In it craftsmen are afforded the opportunity for the practical study of those branches of their craft which they have little chance of learning in the workshop. Students in these classes are encouraged to study design, drawing, casting in metal, enameling, and other subjects bearing on their craft. The workshops of the school are provided with all the appliances and tools needed by silversmiths, and goldsmiths, engravers, chasers, repoussé workers, carvers, etc. The teaching is individual throughout, and the work is adapted to the capacity of each student. Special attention is given to the production of particular articles, such as chalices, flagons, cups, badges, and the like.

Bookbinding: This class offers instruction to journeymen and apprentices working at the trade. Pupils are expected to carry out, from first to last, the binding and decoration of books and to design and work out their own patterns. The workshops are fitted with all necessary appliances for forwarding and finishing.

Lithography: This class is strictly confined to those who are genuinely engaged in the lithographic business either as draftsmen or designers. Instruction includes drawing on polished stone (pen work); drawing on grained stone (chalk work); drawing on transfer, grained, and other papers; drawing on zinc and aluminum; lithography in color, and combinations of lithography with photographic processes, such as collotype and "halftone."

Besides the above-enumerated classes, instruction is given in such art subjects as modeling, drawing from life, and embroidery, and also in engraving and printing in color from wood, wood carving and gilding, and cabinetwork and wood inlay.

The school is under the control of the London County Council and is largely maintained by appropriations made by that body. The staff of instructors numbers about thirty-five.

General benefits have come to the industries of the community because of the increased intelligence and efficiency of the working classes. Employers show a decided preference for former students, and such students command steady employment and rapid advancement.

NORTHAMPTON INSTITUTE (CITY POLYTECHNIC), CLERKENWELL, LONDON.

The Northampton Institute forms one branch of the City Polytechnic,[a] and began its work in 1896. It provides classes in technological and trade subjects, while the other branches are devoted almost entirely to commercial and science and art subjects, technique and the trades being scarcely touched by them. Clerkenwell is thronged with small workshops representing a variety of trades, and the aim of the school is to provide instruction for those employed therein. Watch and clock making is the most prominent trade in the district and the first instruction given in the school was in that trade and in electrotyping and art metal work. The district is also a center of optical works and shops for instrument making. In 1900 the day college was established for mechanical and electrical engineering and horology. The greater part of the work of the school consists of evening classes in different trades and industries. The work is divided into two main sections, an educational section for technological subjects and a social and recreative section. The school is available to members, associates, and students. Members and associates must, as a rule, be between the ages of 16 and 25 years, but there is no limit of age as regards students. Among the privileges of members and associates are free admission to the library and reading rooms, the use of the gymnasium, reduced fees in technical classes, and the privileges of the Birkbeck Institution and the City of London College.

The educational work of the institute is divided into the following departments: Mechanical engineering and metal trades, artistic crafts, applied physics and electrical engineering, electro-chemistry, horology, miscellaneous trades, and domestic economy and women's trades. These departments are again divided into 83 special courses. The object of such a minute specialization is to meet the requirements of modern manufacturing methods and so afford pupils opportunity to concentrate their time upon whatever special subjects may be best suited to their respective needs. Modern methods of manufacture employ processes derived from widely different sources, and intelligent craftsmen must necessarily have a fair knowledge of more than one science. Notwithstanding the numerous special courses provided, students are strongly urged to take some broad and complete course.

[a] The other branches of the City Polytechnic are the Birkbeck Institution and City of London College.

There are 49 complete courses provided sufficient, it would seem, to meet the most exacting requirements of the craftsmen of the district.

The day school is devoted almost entirely to courses in electrical, mechanical, and horological engineering. These courses are very broad and thorough, and include mathematics, mechanics and mechanism, elements of machinery, machine design, materials and their properties, strength of materials, practical physics, electrical technology, chemistry, and ample workshop practice.

A complete system of instruction for evening classes is arranged in workshop drawing as applied to the metal trades. This comprises the preparation and use of drawing instruments, geometrical problems, etc.; the preparation of working drawings of simple machine parts; later of more complicated parts, and, finally, of the whole machine; special work in practical machine designing, etc. The courses are intended for engineering students generally, foremen, chargemen, and leading hands, fitters and turners, pattern makers, smiths, press tool makers, instrument makers, watch and clock makers, etc.

Courses are also given in workshop drawing as applied to the building trades. Besides the preparatory instruction in the use of drawing instruments, etc., various courses are arranged for the instruction of building trades students generally, designers of buildings, carpenters and joiners, stone masons, plumbers, bricklayers, etc.

The following syllabuses of evening courses in drawing and design have been drawn up with a view to meeting the requirements of the various classes of students indicated. In each case the student is specially instructed in the drawing and design applicable to his own trade. Those attending the practical classes in the same subject are expected to prepare the necessary drawings and designs for the work done by them in those classes.

Design for goldsmiths and jewelers: The study of natural forms, flowers, insects, etc., and their adaptation to design for goldsmiths' and jewelers' work. Elementary students make studies of examples of ornament in precious metals of different countries and periods. In the advanced section the designing of jewelry, mountings for diamonds and precious stones, and the coloring of designs are practiced.

Design for diamond mounters: Drawing and design of ornamental forms used in diamond mounting, brooches, pendants, rings, pins, necklaces, head ornaments, tiaras, sprays, and combs; in pencil and also in color, and in white upon dark-tinted card.

Design for silversmiths: Free-hand drawing of shapes used in silversmiths' work, and the preparation of working drawings; design and its application; the making of full size and scale sketches in pencil and color; the study of different styles from drawings, photographs, and also from a collection of casts and electrotypes lent by the science and art department of South Kensington.

Design for chasers and embossers: Free-hand drawing from outline, casts, or photographs, and also from plant forms, the adaptation of these to design; setting-out of working drawings for chasers, in pencil, pen and ink, or monochrome.

Design for engravers and enamelers: Free-hand drawing and study of ornamental lettering, monograms and forms suitable to engraving; design and preparation of sketches, and the study of harmonious coloring as applied to enameling.

Design for heraldic ornament: This subject is dealt with in a series of short lectures illustrated by lantern slides and diagrams on the blackboard, of old and modern examples of heraldic ornament, and followed each evening by practice in drawing and designing of heraldic forms and their application to artistic crafts. The course comprises historical development of heraldry; its origin and growth during the middle ages; its subsequent decline and revival; the laws of heraldry; how to treat the metals, colors, and furs used, either in color or by line; divisions of the shield, the ordinaries, subordinaries, charges, etc.; blazoning the heraldic charges, and the terms used in describing the various coats; crowns and coronets; crests and badges; helms; supporters; mantling and lambrequins.

Design for decorative metal work: The adaptation of design to articles of artistic craftmanship, special importance being given to the drawing and design of electric-light and gas fittings, chandeliers, and lamp standards; designing for ecclesiastical and domestic metal work.

Design for ornamental ironwork: Geometrical drawing so far as it has direct relation to the subject; drawing and setting out of full-size and scale designs for reproduction in wrought iron; copying of old examples of ironwork of the best periods from engravings and photographs; study of the characteristics of the various styles. Design for ironwork grilles, gates, screens, railings, lamp and gas standards, and for general purposes; the application of wrought iron, either alone or in combination with other metals, for electric-light and other fittings.

Design for wood carvers: Free-hand drawing of carving from reproductions, casts, etc., and the study of plant forms suitable to the design required in wood carving; study of design, and the preparation of working drawings of an architectural character; the design suitable for enrichment of moldings, etc.; the different styles of ornament applicable to wood carving.

Ornamental design for woodworkers: The study of decorative features of woodwork, as used in the construction and furnishing of buildings, is chiefly dealt with, and the following subjects are embraced: Free-hand drawing, sketches, and scale drawings of details from examples of work of different periods. In the advanced section students prepare original drawings and designs suitable for reproduction, and in accordance with the requirements of modern architecture.

Design and setting out for cabinetmakers: Drawing and design for furniture, cabinetmaking, and joinery; the working out of scale drawings, and setting out of full-size working drawings, showing details and methods of construction; design of interior fitments and architectural woodwork; the study of moldings, their names, when used, and their combinations; the qualities and growths of woods and their special characteristics.

Design for painters, decorators, and writers: This class supplements the teaching in the practical classes, and students prepare the designs and drawings required for that purpose. The course comprises the study of ornamental details of painters' and decorators' work, and of lettering and sign writing; the preparation of sketches and designs in outline and color from natural forms and historic ornaments, and also of schemes of decoration for interior and exterior work.

Architectural ornament for builders: The subjects included under this heading form the advanced courses for building-trade students. The course includes design and its application to architectural ornament, and examples of decorative features of various styles. Photographs, reproductions, and casts taken from examples of classic, mediæval, and modern architecture are provided, and students make studies from these to enable them to become familiar with their various characteristics. They are also expected, in conjunction with the special course on the design of buildings, to supply the decorative features and ornaments of the designs prepared by them. Opportunities are given for advanced students to supplement their work by study in the modeling classes.

Ornamental design: This class is supplementary to the drawing and design classes already enumerated, and consists of short lectures throughout the session, illustrated by lantern slides, diagrams, sketches upon the blackboard, and specimens of handicraft of various kinds. The course includes a consideration of the principles underlying all ornamental design; the laws governing the arrangement of line, form, and color; the study of natural forms and plants, and their application and adaptation to design; the geometrical and systematic arrangement of forms; the influence of architecture upon the style and conditions of ornamental design; the characteristics of materials and their influence in design in stone and marble carving, metal work, jewelry, silversmiths' work, woodwork, joinery, and cabinet work; color and its position in decorative art; the influence of historic and natural conditions upon design, and the special features of different styles and periods, with a consideration of the growth and development of ornament from the early to later periods.

Books, casts, photographs, and actual specimens of artistic workmanship are used in this class to illustrate fully the subjects dealt with, and students are expected to make sketches, drawings, and designs illustrating the various subjects dealt with during the session.

Besides the courses in drawing and design, the following evening courses of a practical nature are given, relating to the more important trades:

Workshop calculations (engineering and metal trades): This course is intended for all students in the engineering and metal trades classes who are not thoroughly grounded in the methods of calculation, and includes the following subjects: Weights and measures; simple calculations; fractions and decimals; square roots; areas of rectangles, triangles, circles, and irregular figures; use of squared paper; determination of the cubical contents of tanks, cylinders, cones, etc.; use of logarithms, slide rule; algebraic calculations. Examples are selected suitable to each class of trade students, such as calculating the weight of heavy castings, the sizes of pulleys and change wheels, speeds of machines, quantity of material to be used for given work, calculations in mechanics, etc.

Pattern-making shop: This course of work is arranged to suit the individual needs of the students as much as possible, and the examples are so selected as to exemplify some important point in pattern making. The subjects dealt with comprise the position of mold joints; contraction of castings; amount of taper necessary; allowances for machining; loose parts for undercut molds; cores, core boxes, and prints; the halving of patterns; use of ramming boards; the turning of patterns in halves; methods of arranging patterns which have to be molded in three-part boxes; construction of patterns for strickling up molds in loam; use of skeleton patterns; lagging and building up in segments patterns for gearing, with the method of striking out teeth; materials and teeth used in pattern making; numbering, registering, and storing of patterns, etc.

Practical smith work: This shop is open every evening except Thursdays for the students attending the engineering workshop classes. A skilled smith attends on Thursday evenings to give special instruction to those wishing to take up smith work entirely. The shop is equipped with the most modern appliances for the heating and forging of iron, brazing, and welding. Gas furnaces and brazing tables have been introduced into the smithy, that students may not only carry out ordinary smith's work, but also be taught the management of a new type of heating appliance.

Practical cycle making: This class meets in the engineering workshop, and has the use of the machines and tools with which that shop is equipped. Two good brazing hearths, with gas torches, are fitted in the smithy, and are available for the students of the class. The practical work consists of practice in brazing, the fitting together,

brazing up, and setting of a frame, the construction of parts, bending handle bars, wheel building, etc. Students attending this class must also attend either the course of lectures on cycles and their construction or the drawing classes for cycle makers, or both these classes.

Practical diesinking and press-tool making: In this class is carried out a practical course of work in the making of tools for cutting out, pressing, stamping, and piercing. Sets of tools are made for producing small articles. The types of tools it is proposed to work upon are dies and punches for cutting out and piercing with single and multiple punches, simple dies and forces for both pressing and stamping, tools for drawing through and deep drawing, combination tools for simple-action press, compound tools for double-action press, triple-action tools, preparation of forces and forcing dies. Special instruction is given in hardening and tempering tools when finished. Short lectures are given explaining recent practice in press-tool making.

Brass finishing: This class is specially intended for these engaged in brass founding and its allied trades, such as valve and clock makers, chandelier manufacturers, electrolier and lamp manufacturers, fancy brass workers, and others. The work to be carried through includes various electrical switches; cocks and valves for water, gas, and steam; patterns and core stocks; tube work, gas brackets, lamp stands, candlesticks, and clock frames; electric-light pendants, etc.

Practical metal-plate work: The work in this class is carried out on the following lines: A suitable example having been selected, the student first sets out the necessary templates by geometric methods, making proper allowance for overlapping, beading, etc. Sheet metal is then cut out and worked up into the finished article. Short explanations are given on the properties of metals; the properties and action of acids on metals; the combined action of heat and air on various metals; turning processes; composition of solders; behavior of metals when hollowed, raised, stamped, and planished; brazed, soldered, grooved, and riveted joints; some examples of practical mensuration.

Carpenters' shop: This shop is equipped with a band saw, having a fence for straight sawing, 2 wood-turning lathes, a molding spindle, all electrically driven, besides a complete kit of hand tools for all classes of carpenters', joiners', and pattern makers' work. The students are divided into groups according to their ability. The general work of the classes includes:

Section A.—The tuition needed by apprentices and others who have commenced work in the carpentry and joinery, cabinetmaking, coach-building, and other woodworking trades. The workshop practice is supplemented by oral tuition on the nature and properties of timber, the use of geometrical methods in setting out work, and such other subjects as may be deemed necessary. The soft and hard woods commonly used in carpentry and joinery; seasoning and conversion of timber; names, uses, and management of woodworking tools; sharpening and setting various tools; the use of glue, nails, screws, wedges, keys, tongues, pins, dowels, treenails, screw bolts, and other fastenings; marking out and cutting up stuff; face and edge planing; gauging and striking joints; striking simple moldings; operations of carpentry and joinery; technical terms; grooving, plowing, rabbeting, mortising, and tonguing; miters; shooting; dovetailing, clamping, housing, blocking, and bracketing; match boarding; furring and fillets; heading joints; veneers; inlaying and parquetry; plugs and battens; scribing; beveling and splaying; wedging, throating, raking, and framing; paring straight and curved surfaces; oblique and tusk tenons; construction of carpentry joints; lapping, fishing, scarfing, tabling, halving, notching, cogging; joggles, bridles, and straps; description and methods of fixing various kinds of locks, hinges, and window fasteners, floor hinges, door springs, door and gate swing, and slide arrangements; descriptions of woodworking machinery; vertical, circular, crosscut, and band saws; planing, molding, mortising, tenoning, and boring machines; universal joiner and spindle machines.

Section B.—Intended to suit the requirements of journeymen and adult artisans who have had a fair degree of workshop experience. The practical work taken will be correlated to section 15 of the workshop drawing class for woodworkers, the working drawings prepared in that class being intended for actual construction in the shop. The syllabus for workshop drawing may be taken as a sufficient indication of the course in contemplation.

Section C.—More difficult and highly finished work than that taken in the preceding section. It in general corresponds with the work of the advanced drawing for woodworkers.

Section D.—Exercises on use of the square, sketching details of carpentry work, and explanations of processes.

Practical plumbing: Exercises are arranged in ordinary plumbers' work, such as marking off and cutting out sheet lead for cesspools of different shapes, cone pieces, etc., lead laying, including gutters, flats, hips, and ridges; bossing-up cesspools, covering finials, breaks, etc.; pipe bending up to 4 inches diameter; trap making; joint wiping in vertical, horizontal, and other positions; lead burning by sand, copper bit, and hydrogen burner; mixing solders.

This class, together with others in the course for plumbers, is intended to prepare students for the examinations of the City and Guilds of London Institute in plumbers' work, and only those who are prepared to take the full course will be admitted to the practical class.

Practical brick cutting: The workshop is fitted with all the necessary appliances for practical work, and therefore students have every opportunity to carry out good work. Each student receives individual instruction, and the work is arranged if possible to suit the students' requirements. The practical work includes the setting out and preparation of gauge work in walls, piers, and columns and in cornices, domes, niches, vaults, and arches of both plain and double curvature. In addition explanations and notes are given on the properties and uses of bricks, tiles, terra-cotta, etc., and the various cementing materials in common use.

Practical plastering: The workshop is well arranged for all classes of plasterers' work. In addition to the necessary work benches, plasterers' table, and tools, special stages have been constructed so that students may plaster the walls, strike cornices, fix ceiling patterns, etc. The course includes the use of hydraulic and nonhydraulic limes; the method and time of slaking; sand, the proportion of admixture for various limes and purposes; use of hair; mixing and tempering of rough, fine, and gauged stuff, run putty, etc.; the nature and use of plaster of paris and its influence on lime stucco by admixture; setting out and making templates; preparation of molds for casting from in plaster, etc.; casting and fixing; running and mitering cornices; fibrous plaster, its preparation and use; character of cements for external and internal use; method of gauging and using Roman, Portland, and other cements.

Complete evening lecture courses are given for opticians and optical instrument makers who have already had a good training in elementary optical theory.

Laboratory and calculation classes, which are an essential part of the course, have been arranged, and all students are expected to attend them. Following are shown in detail the subjects treated in these courses:

Measuring instruments: Measuring machines, dividing engines, and comparators, their construction and use; standards of length; cathetometers; chemical and physical balances, their construction and testing; chronographs for accurate time measurement; compensation for temperature.

Mathematical and surveying instruments: Simple compasses and miners' dials;

prismatic compasses; levels and clinometers; theodolites and sextants; adjustment and testing of surveying instruments; collimation.

Optical projection apparatus: Construction and mechanical details of various types of optical lanterns; condensers and front lenses; formation of the image; effects of spherical and chromatic aberration and their elimination; projection microscopes. Sources of light—oil, acetylene, oxyhydrogen, electric, etc.

Telescopes, opera and field glasses: Optical principles of terrestrial and astronomical telescopes; use of concave and erecting eyepieces; object glasses; testing qualities of glass, design and construction of object glasses; centering of lenses; Ramsden's and Huyghen's eyepieces; micrometer eyepieces, altazimuth and equatorial mountings; determination of the magnifying power of a telescope.

Photographic apparatus: Construction of cameras and details of adjustments; single landscape lenses, their design and construction, use and calculation of stops; symmetrical, portrait, rectilinear, and anastigmatic lenses; calculation of lens curves; centering of lenses. Testing of photographic lenses, focal length and depth of focus, covering power, distortion, chromatism, astigmatism, flare spot, etc. Types of diaphragms—Waterhouse, iris, etc. Construction and testing of time and instantaneous shutters.

Microscopes and objectives: Theory of the compound microscope; mechanical construction; English and continental stands; rack work and fine adjustments; simple and mechanical stages; substage illuminators; construction and use of ordinary and substage condensers, spot lenses, paraboloids, Lieberkuhns, etc.; binocular microscopes; camera lucida and other accessories; micrometers; objectives of low and high power, their design and construction; centering; correction collars; water and homogeneous immersion objectives; interference and defraction, and their influence on the resolving power of a lens; Abbe's defraction theory; testing objectives.

Spectrometers and polarizing apparatus: Construction of chemical spectroscopes; spectrometers and goniometers; direct vision and defraction spectroscopes; testing and adjustment of spectroscopes; tourmalines; Iceland spar, Nicol prisms, selenites; construction of microscope and projection polariscopes and polarimeters; construction and testing of spar, selenites, and other crystals; cutting and mounting specimens, etc.

Following is a statement of the equipment in connection with the electrical and physical laboratories:

The junior electrical laboratory: This laboratory is already well equipped, and affords facilities for experimentally proving all the fundamental electrical laws, and also of carrying out all the testing work required in most factories and test rooms. The apparatus is of the most modern construction, and gives students an opportunity of becoming familiar with all the well-known types of instruments, such as reflecting and other galvanometers, permeameters, magnetometers, etc.

The telegraph and telephone laboratory: The equipment in this room consists chiefly of apparatus specially lent by the post-office authorities. It includes examples of the most recent patterns of signaling and testing instruments, and the students are exercised in the arrangement and connecting up of circuits and instruments as nearly as possible under practical conditions.

The electrical engineering laboratory: This laboratory contains several dynamos, motors, and transformers for testing, and the equipment is being increased. The machines are mounted on sliding rails, embedded in a concrete foundation, in such a way as to be rapidly movable and to be available for every possible test. Alternating currents of various frequencies and potentials are available, together with a large amount of direct-current power from the generating plant of the institute. Transmission and absorption dynamometers are being provided, and special arrangements made for calibration of heavy current and engineering instruments. Oscillographs and other devices for studying wave form are also available.

The power house: This room, which is used in conjunction with the mechanical

engineering department, contains at present a Babcock and Wilcox and a Lancashire boiler, each of 100 horsepower. These supply steam by a ring system of pipes to a 63-kilowatt Willans-Holmes combined engine and dynamo, which supply current for the lighting of the institute and for the necessary power, and they are also arranged with facilities for carrying out separate or combined trials on a large scale Tests are made by the students on this plant, in conjunction with the mechanical engineering department, at intervals during the session. The equipment will be increased by the addition of 100-horsepower slow-speed engine, rope driving a 63-kilowatt multipolar dynamo, already delivered, and also by a 20-kilowatt 500-volt to 100-volt motor transformer. Tests will be made on these machines, and also on the distribution of power to the workshops, which are driven by electric motors supplied by different makers, so that as many types as possible shall be available for experiment under working conditions.

The senior electrical laboratory: A large laboratory has been equipped with accurate standards and other apparatus for advanced work in electrical testing and standardizing, and for investigation work. Arrangements are being made for special advanced tests in telegraphic and telephonic work.

The senior physical laboratory: This laboratory has been equipped with apparatus for accurate measurements in heat and optics. Arrangements are being made for the accurate measurement of the heats of combustion of various fuels, the determination of the thermal properties of gases and vapors, and for the testing and adjustment of accurate and delicate mathematical and optical instruments.

The optical laboratory: A special laboratory has been set aside for photometry and for delicate optical experiments requiring a darkened room. The whole room is carefully blackened, and is already well fitted with optical benches, spectrometers, and photometers of various kinds, enabling students to test the focal lengths of mirrors and lenses, the refractive and dispersive powers of various kinds of glass, the qualities of microscope objectives and photographic lenses, etc.

The following syllabuses give some details of practical work carried on in the instrument shop, but as a rule students are not required to make complete instruments unless they desire to do so for a scholarship competition:

Electric-light wiring and fitting: Preparation of fluxes; use of rubber and proof tape and solution; jointing and insulating single and stranded conductors; concentric and lead-covered cables; use of couplers; joint and house service boxes; vulcanizing rubber joints by hot and cold processes; use of ordinary and portable cures; special systems of wiring, e. g., paper insulated, C. C., Andrews's, Simplex, Conduit and Insulation Company's; use of bare wire and strip; wiring for heavy current and high-voltage circuits; wiring all kinds of fittings; sizes and connection of fuses; connection of dynamos, motors, and accumulators, and of starting and automatic switches; electric bell and telephone wiring; testing joints and circuits mechanically and electrically; detection of faults.

Telegraph and telephone wiring: Jointing single and stranded iron, copper, and phosphor bronze wires; preparation of fluxes; jointing and insulating rubber and gutta-percha insulated wires and cables; vulcanizing rubber joints; jointing lead-covered, low capacity, and telephone cables; making wiped joints on lead-covered cables; mechanical and electrical testing of joints and circuits.

Electrical engineering: Held in the engineering workshop of the mechanical engineering department. The students are practiced in the use of the various machine tools and appliances to be found in most modern machine shops. Should a sufficient demand arise, a workshop class is contemplated in armature and transformer winding, in which the winding of various kinds of ring, drum, and disk armatures for direct, alternate, polyphase, and multipolar dynamos and motors would be taken up.

Electrical instrument making (preliminary): For electrical instrument makers who have not had a long workshop experience, and who are not specially devoted to telegraphic or railway work. A trial piece of work is given to each student at first, and his subsequent work depends upon the way this is done. Simple switches, keys, and galvanometers, ammeters, and voltmeters are constructed during the session.

Electrical instrument making (advanced): For electrical instrument makers who have had a good previous training. This course deals with the best means of production of various parts of instruments by means of repetition machinery and otherwise; the various methods of producing the most highly finished work in plug keys, resistance boxes, reflecting galvanometers, pivoted instruments, etc.

Telegraphic instrument making: For students working in the Postal Telegraph factories, but not restricted to them. The work set is adapted to the special requirements of students from the Holloway and Mount Pleasant factories, and the instruments constructed include single and double current keys, needle instruments, ordinary and double plate sounders, relays, etc. Special instruction is given in the setting of tools for repetition machinery and the use of machine tools.

Railway telegraph instrument making: The work is similar to that of the preceding class, but the instruments dealt with are those more specially used in railway work—as, for example, single needle and sounder instruments, block semaphores, repeater dials, contact boxes, expansion tubes, point locks, rail contacts, step-up indicators, etc.

Optical and mathematical instrument making (preliminary): Students employed in optical and mathematical instrument shops in the daytime, and who have not had a long experience, have an opportunity of extending their training and gaining a general knowledge of workshop practice. A trial piece of work is given to each student on commencing, and on its completion the construction of parts of simple optical instruments such as lens cells, simple microscopes and telescopes, etc., is taken up.

Optical and mathematical instrument making (advanced): For students with a good previous training. The work deals with the construction of parts of surveying instruments, the turning and grinding of theodolite centers, and the making of the brass work of microscopes, objectives, and other optical instruments.

Optical glass working: A special workshop is being equipped for the purpose of instruction in hand and machine grinding and polishing of lenses for spectacles, cameras, telescopes, and microscopes.

Tool making for instrument makers: A class in tool making for instrument makers is held on Monday evenings for instruction in the making of ordinary hand fitting and turning tools, and especially in the construction of tools for repetition machinery and the setting of such machines.

Practical workshop demonstrations: To give electrical students a wider knowledge of workshop processes than can be gained by a single evening's practical work, a series of demonstrations is given on Wednesday evenings after the lecture on electrical instruments. The work is valuable to students taking the optical and mathematical instrument making class. It includes shaping, hardening, tempering, and grinding lathe and other tools; working in iron, steel, brass, copper, aluminum, ebonite, fiber, slate, marble, etc.; best speeds and treatment for each material; use of Whitworth and B. A. taps and dies; hand chasing of outside and inside threads; mounting of platinum contacts; setting off and mounting work; finishing, bronzing, and lacquering; boring, surfacing, and taper turning; chucking of various kinds of work; making and use of fly cutters, milling cutters, broaches, etc.; cutting of micrometer threads and of cycloidal, involute, and helical gear wheels; pivoting and jeweling of galvanometers, telegraph instruments, etc.; making, hardening, and magnetization of permanent magnets; treatment of iron and steel for electromagnets;

making, hardening, and tempering of springs; silvering, etc.; use of repetition machinery for turning out simple parts; adaptation of ordinary lathes for repetition work; profiling and other special processes; mechanical testing and inspection of instruments for faults; making Kelvin galvanometer needles; winding Kelvin and d'Arsouval galvanometer coils; mounting of mirrors, and damping tubes; winding and roughly adjusting resistance coils; mounting in boxes and waxing; annealing of manganin and similar wires; artificial aging of resistance coils and magnets; setting and adjustment of electromagnetic instruments.

Optical workshop: Roughing, turning, grinding, and polishing simple lenses for spectacles, etc.; centering, edging, and fitting spectacle lenses; grinding and polishing of plane and cylindrical lenses and prisms; determination of axes of cylinders and prisms; mounting of lenses; use and properties of the different kinds of crown, flint, and Jena glass; workshop tests of glass for uniformity and optical properties; construction of achromatic combinations, centering and cementing surfaces; making and gauging curves of grinding and polishing tools; composition and making of cements, polishing waxes, pitch tools, balsam, etc.; washing and grading emery; use of machinery in grinding and polishing plane, spherical, cylindrical, and spherocylindrical lenses; making the optical parts of various optical instruments, object glasses for telescopes, cameras, microscopes, etc.; positive and negative eyepieces, micrometer eyepieces, etc.

Complete evening courses in clock making and watch making have been arranged and are shown in detail as follows:

First year's courses in clock making: In the class for workshop drawing for clock makers the student is first grounded in the general principles underlying all workshop drawing, and when sufficiently advanced is exercised in special work connected with horology, such as gearing, escapements, movements, etc. The course includes the preparation and use of drawing instruments; geometrical problems; construction of scales; drawing to scale; representation of solid bodies; projection of plan, elevation, and side views of various solids; sections; drawings of various kinds of escapements and movements; curves for toothed wheels, etc. The course is preparatory to the second year's course in technical drawing at the British Horological Institute.

The course in mechanics consists of both lecture and laboratory work. Students are not required to attend the whole of the lectures on "Mechanics and mechanism," but only to such portions as are applicable to the science of horology. These consist of ten lectures and laboratory demonstrations.

The course in physics also consists of both lecture and laboratory work and is a portion only of the course on heat and its applications. It consists of fourteen lectures, with corresponding laboratory work. The subjects dealt with are those parts of physics of especial interest to students of horology.

The course in practical clock making comprises the following: In the first year's course the work is confined to the methods of manufacture of simple forms of English timepieces. It consists of filing, scraping, polishing, turning with throw and lathe; screw making; pivoting, mounting, and colleting wheels; pitching the depths; making the pendulum, barrel, and hands; making and planting the escapement. The workshop is equipped with benches, vises, throws, lathe, anvil, grindstone, and similar large tools, but students must provide themselves with files, gravers, and small bench tools. Lockup drawers are provided for each student.

Second year's course in clock making: Classes in technical drawing and theory of clock making are held at the British Horological Institute, though in connection with the latter class there is from time to time laboratory work at the Northampton Institute.

The class in practical clock making is held in the workshops of the Northampton Institute, and consists of more advanced work than that detailed for the first year's

course. Only those students are admitted who can show that they are sufficiently advanced to profit by the instruction. Students must provide themselves with the necessary bench tools and small tools; the larger tools are provided in the workshop. The course includes the methods of construction of regulators; striking clocks and electrical clocks; maintaining powers, dead-beat escapements, compensation pendulums.

The complete second year's course in clock making is specially adapted to the requirements of candidates who desire to enter for the examinations conducted by the City and Guilds of London Institute and by the British Horological Institute.

First year's course in watch making: The course is precisely the same as the first year's course for clock makers, and consists of workshop drawing, mechanics and physics, and practical clock making.

Second year's course in watch making: Classes in technical drawing and theory of watch making are held at the British Horological Institute under the same conditions as those for the second year's course in clock making.

The class in practical examining, springing, and timing is held in the workshops of the Northampton Institute, and is open only to those who have had some practical experience in watch making and can show that they are sufficiently advanced to profit by the instruction. The course comprises: (1) Examining—The escapement; the train; the mainspring, barrel, and stop work; end shakes, side shakes, and freedoms; the keyless work; final fitting of movement to case; fitting the dial, motion work, and hands; putting together and oiling. (2) Springing and timing—Selection of a suitable spring; counting; pinning to collet and stud; pinning in equal coils; Breguet springs; making the over coil with or without regulator; adjusting for temperature, isochronism, and positions.

The workshop is equipped with benches, vises, regulator, timing oven, etc., but students must provide their own bench tools. Lockup drawers are provided for each student. Students desirous of making up a complete watch are guided and advised by the instructor, who superintends the construction throughout.

The complete second year's course in watch making is specially adapted for the requirements of candidates who desire to enter for the examinations conducted by the City and Guilds of London Institute and by the British Horological Institute.

The miscellaneous trades department offers technical lectures for the printing trades to those already employed in the trade, and also instruction in upholstery for journeymen and apprentices. The domestic departments provide courses for women in trade dressmaking, ladies' tailoring, and upholstery. These courses are intended for apprentices and the design is to provide such instruction as they are not able to get in the shops.

The institute provides well for the social enjoyment of its pupils. There is a large hall for popular entertainments. There are also a gymnasium, a swimming bath for men, and one for women, library and reading rooms, club rooms, and commodious refreshment rooms. These conveniences are not all entirely free, but the fees are small enough to make them available to every pupil.

The teaching staff consists of about 70 instructors, besides a number of teachers in music, gymnastics, and swimming. The school is supplied with ample workshops well equipped with necessary tools and machinery, and with suitable laboratories.

The students, as a rule, find ready employment at remunerative

wages. They enter the shops as apprentices, or else are working as such while attending the school. Employers prefer them on account of their superior intelligence and efficiency. There is little trade unionism in the neighborhood of the school, except among plumbers, and they are not altogether friendly to its work.

REGENT STREET POLYTECHNIC. 309 REGENT STREET, LONDON, W.

This school may be said to have been the beginning of the national polytechnic movement in Great Britain. It had its origin in a "ragged school" for boys, founded in 1863 by Mr. Quintin Hogg. In a very short time the attendance grew to 120, and in 1865 a second room was secured to accommodate the increasing numbers. In 1873 an institute was founded and some half dozen classes were formed. At the end of the first year 48 boys were enrolled. The next move was to still larger premises in Long Acre, but the limit of the capacity of the new quarters was soon reached. At the end of seven years the membership roll was full and more than 100 candidates were constantly waiting for admission. In 1881 the property of the old Polytechnic was purchased at a cost of £50,000 ($243,325). These new premises were occupied in 1882, and within seven years alterations, additions, and improvements were made to the amount of £100,000 ($486,650). Recently another building has been purchased, and still there is not room. From the two ragged sweepers in 1863 the membership has grown to 12,000. From the small class in the simplest rudiments of a common education has grown the great institute whose curriculum covers a broad field of instruction in art, science, commerce, technology, and the trades. The institute is open every evening in the year except bank holidays and Sundays. For the small fee of 10s. 6d. ($2.56) per year members are entitled to the use of the library, reading room, conversation room, social, chess, and drafts room, and the gymnasium. They also have the privilege of joining clubs and classes for entertainments at purely nominal rates.

The day school provides general instruction for boys of 9 years of age and upward, and also special courses in architecture, engineering, commercial subjects, and a trade course for carriage builders. The school for carriage builders offers instruction in the nature and properties of all materials used in the construction of a highly finished carriage; selecting and testing materials, and marking out without waste; drawing, sketching from carriages, taking measurements, and carriage designing; and practical shopwork in working from drawings, making sections, painting, trimming, and smith's work. The day school offers instruction for girls in chemistry, drawing and painting, piano and singing, violin, swimming, dressmaking and needlework, cookery, and shorthand.

The boys' continuation school has classes arranged for the usual English subjects, modern languages, mathematics, chemistry, mechanics, physics, freehand and machine drawing, laboratory practice, and workshop instruction in engineering and carpentry. This school is open to boys from 11 to 17 years of age.

The principal part of the trade instruction of the institute is given in the evening classes. Prominent among the courses is that for carriage builders, which is substantially the same as that provided in the day school and described above. Perhaps the most prominent school in the institute is the photographic trades school. It is claimed for this school that of those engaged in the various branches of the trade in London more are present or past students of the school than is the case with any other industry and its corresponding school. The full field of instruction covered includes camera manipulations, negative making, developing, exposures, selection and use of lenses, copying, orthochromatic work; portraiture, art in relation to photography, landscapes, and architecture; preparation of negatives for printing, intensifying, and reducing; gelatino-chloride, collodio-chloride, and albumen printing, and enameling, mounting, and finishing; platinum, carbon and lantern slide printing; bromide printing, enlarging, and enlarged negative making; retouching; finishing in black and white; photogravure; line and screen negative making with both wet and dry plate; zinc and copper line and tone blocks; and tricolor photography and photolithography. Practical demonstration in portraiture can not be given in the evening, but full and detailed instructions for working are given by special teachers, and the exposed plates are developed and finished in the class.

Other practical trade classes are boot and shoe making, including clicking and pattern cutting, and last fitting; carpentry and joinery, metal turning and fitting, erecting, dynamo building, and bicycle making, plumbing, upholstery, typography, including instruction on the linotype machine, gentlemen's and ladies' garment cutting, and metal plate work. Practical instruction is offered to young women in dress cutting, dressmaking, millinery, and cookery.

Technical classes are arranged for all trade classes, and in addition to these are classes for teaching technology to bricklayers, masons, cabinetmakers, and gas manufacturers.

The science school covers a very extended series of subjects relating to such practical professions as biology, geology, mineralogy, botany, electricity, chemistry, etc. The school of art provides instruction in designing, modeling, drawing, sketching, and painting. There are preparatory classes for the civil service, music, elocution, and such commercial and general subjects as bookkeeping, shorthand, typewriting, political economy, ancient and modern languages, and instruction for sick nursing.

The governing body consists of 16 men nominated by the charity commissioners, and in them is the title to the institute property.

Of the more than 12,000 students in 1901, nearly 1,000 were in the day schools, and about 4,000 were in the evening trade classes.

The cost of maintaining the institute for the year ending July 31, 1899, was £38,311 ($186,440), which was £5,296 ($25,773) more than the receipts from all sources. The principal sources of income were: Fees, £12,497 ($60,817); prizes from the City and Guilds and science and art department, £2,942 ($14,317); grants by London County Council, £7,470 ($36,353); grants from city parochial charities, £5,218 ($25,393), and donations by Mr. Hogg and Mr. J. E. K. Studd (Hon. Sec.) £3,000 and £1,500 ($14,600 and $7,300), respectively.

The mental, moral, physical, and manual training given to the thousands of boys and young men who have attended the institute has had beneficial effect upon the industries of London.

The preference for past students by employers is manifested by many large firms taking them into their establishments without payment of the usual apprenticeship fee. The day classes for carriage builders were founded by British carriage manufacturers.

That the work of the school has been eminently satisfactory is attested by its wonderful growth and the favor it has met with among craftsmen, employers, and public men who are devoting their energies to the improvement of the working masses. It is taken as the model institution of its kind in Great Britain.

THE GOLDSMITHS' COMPANY'S TECHNICAL AND RECREATIVE INSTITUTE, NEW CROSS, LONDON.

This school was founded by the Goldsmiths' Company in 1891. It has rejected aid from the charities commissioners and the London technical education board, thereby refusing to join forces with the polytechnics, and is therefore freer to admit students not at work at trades than are the various polytechnic schools.

The fees for a session of seven months range from 3s. to 15s. ($0.73 to $3.65). The board of governors has provided, however, that a limited number of artisans and craftsmen may be admitted to certain classes upon payment of half the ordinary fees. Such students must state the exact nature of their employment, which must be certified by their employer, manager, or the secretary of their trade union. The classes they seek to enter must bear some direct relation to their employment.

The school is divided into two general departments—the educational and the recreative. The educational department is again divided into a day department and an evening department. The day classes include the art school, music, commercial and civil service, and electrical engineering. The evening classes include mechanical and building

engineering, chemistry, mathematics, and physics, miscellaneous trades—plumbing and tailors' cutting—women's classes, and all the subjects of the day classes.

The various engineering courses offer thorough theoretical instruction in all necessary subjects and practical shop training according to the special needs of students. The practical classes arranged for building students and others employed as artisans, craftsmen, or trade apprentices cover a number of subjects.

The full course in carpentry and joinery extends over three years. The first year is devoted to geometry, building construction, and lectures on carpentry; the second year takes up practical shopwork, and continues building construction and carpentry lectures; the third year is principally devoted to building construction and practical shopwork. The practical work covers not only carpentry and joinery proper, but also includes household cabinet work. Drawing forms a part of each year's work.

A three years' course is arranged for the subject of masonry and bricklaying. The first year covers building construction, brickwork drawing, and brick cutting; the second year is devoted to geometry and building construction, and the third year's work embraces mathematics, applied mechanics, brickwork drawing, brick cutting, and sanitary engineering. Free-hand drawing is taught throughout the course as the student has the time to devote to that subject.

The first year's work in the pattern-making course is the same as that for carpentry; the second and third years carry the student through the various stages of theoretical study and shop practice necessary to equip a good workman.

The metal plate work and boiler making course extends over two years of very thorough training. The lectures take up all the technical details of the trade in their natural order, including measurements, methods of construction, development of parts, composition of materials, etc. The shopwork embraces practice in all of the numerous operations necessarily performed by the highly skilled craftsman.

The lectures arranged for the course in plumbing cover mensuration, density of materials, solder and other alloys, the effects of heat, physical and chemical properties of metals used in plumbing, sanitary appliances, water supply, ventilation of drains and buildings, and hot-water heating. Practical exercises in drawing, planning, estimating, and general shopwork are given through the entire two years covered by the full course.

There is also practical instruction provided for students in chemistry, drawing and design, modeling, wood carving, repoussé work, and tailors' cutting. Besides the subjects just enumerated such household subjects as cookery, laundering, dressmaking and millinery, and housewifery receive careful attention. The dressmaking and millinery courses

prepare women for the City and Guilds examinations, and appear to be designed to fit them to enter upon apprenticeships in these trades.

The school is governed by an office staff selected by the Goldsmiths' Company. About 2,000 students attend the evening classes annually.

The school has been instrumental in increasing the general intelligence of working people in its community, and good results have come to the various industries whose artisans attend its classes. Its students find ready employment at good wages. They enter the workshops as apprentices, but they advance more rapidly on account of their school training.

The work of the institution has been satisfactory to all concerned. Employers show an increasing interest in its work, and some of them offer special facilities to those of their employees who desire to attend the school.

NORTHERN POLYTECHNIC INSTITUTE, LONDON.

The Northern Polytechnic Institute was established to provide for the inhabitants of Islington and the neighboring parts of North London, and especially for the industrial classes, the means of acquiring a sound general, scientific, technical, and commercial education at small cost, and also to afford facilities for physical training, and for recreation. The building was erected from funds supplied partly by donations from the Clothworkers' Company and other public bodies and partly by voluntary local subscription. The income is derived from an endowment from the City Parochial Foundation, grants from the technical education board of the London County Council, attendance and examination grants from the science and art department and the City and Guilds of London Institute, students' fees, and voluntary subscriptions. Work began informally at the institute on October 5, 1896.

The educational work is conducted for the most part in evening classes; there are, however, day classes in some departments, and the question of the extension of this day work, so as to utilize more completely the building and equipment of the institute during the day, is under consideration.

Artisans and apprentices are allowed to enter for any sessional course at a fee of 10s. ($2.43) for the session; both lectures and laboratory or workshop practice are included in this fee. Apprentices are admitted to trade classes at half rates on presenting a certificate from their employers that they are actually engaged in the trade to which their application refers.

In most cases classes are announced in at least two stages of a subject. Only those students are admitted to the advanced class who show to the satisfaction of the teacher that they are equal to the work. In some cases classes are announced of a still more advanced character.

In some cases, too, preparatory or introductory courses are arranged where it is found that students come insufficiently prepared to profit by the teaching in the ordinary first year's course.

The technological and trade classes, entrance to which is confined to those engaged in the industries concerned, are intended to teach the scientific principles upon the application of which the practice of the various trades depends, and by giving opportunities of gaining manipulative skill to supplement the training in the workshop. The object of the classes is to counteract the narrowing tendency of the extreme division of labor, which allows a man to become thoroughly acquainted with only a small part of his trade. Short courses pointing out the bearings of mechanics, physics, and chemistry on particular industries form a part of the regular work of the institute.

In the women's department classes in needlework, dressmaking, and millinery are now carried on, and arrangements are being made to include courses in cookery and laundry work also.

Many of the classes in science and technology are in connection with the science and art department or the City and Guilds of London Institute; and students, unless disqualified by their teachers, are expected to sit for the examinations of these bodies. The fees charged are on the understanding that students will enter for these examinations when desired; otherwise an additional fee of 10s. ($2.43) is charged for each class.

The work of the institute is divided among several departments, as follows: Mathematics and geometry, engineering and constructive science, building construction and architectural science, physics and electrical science, chemistry, biological and sanitary science, English and civil service, language and literature, commerce and economics, women's work, and miscellaneous classes.

The courses in the engineering and metal-trades department include machine construction and drawing, mechanical engineering, fitting and machine-shop work, smith work, pattern making, metal-plate work (especially arranged for tin, zinc, and iron plate workers, boiler makers, coppersmiths, etc.), and a special course in metal work for teachers. The courses in the building-trades department embrace building construction, architectural drawing, builder's quantities, carpentry and joinery, brickwork, masonry, plasterers' work, painting and decorating, and plumbing. The courses in physics and electrical science take in general elementary science, mechanics, heat, light, and sound, magnetism and electricity, electrical engineering, and electric wiring and fitting. The latter course is limited to those actually engaged in electric wiring and house fitting.

In the chemical department there is a preliminary course in general experimental science, a four-year course in inorganic chemistry, and a two-year course in organic chemistry.

The institute is managed by a board of governors composed of 17 members. The faculty consists of about 60 lecturers and instructors, 25 of whom are engaged in the technical and trade classes. The teachers of the trade classes are all actually engaged in the various trades, and are skilled both in knowledge of their handicrafts and in teaching. The work of these classes consists partly of lectures and drawing practice, and partly of workshop practice under the teacher's direction.

MUNICIPAL TECHNICAL SCHOOL, MANCHESTER.

The object of this school is to provide instruction in the principles of those sciences which bear directly or indirectly upon trade and industry, and to show by experiment how these principles may be applied to their advancement.

Students under 15 years of age are not admitted to the technical classes of the day school. They must produce a reference from the school previously attended and pass the entrance examination, or some qualifying examination. The night school is conducted on liberal principles, and students are not required to take up studies in harmony with their daily shopwork. The school year is divided into three terms, and the fees range from 10s. 6d. ($2.56) per term upward. Nonnaturalized foreigners are charged double fees. Certificates are granted to students who have been constant in attendance, faithful in their home work, and who sit at the term and sessional examinations. A number of prizes and scholarships are available to students. Some of the scholarships entitle the holder to three years' attendance in some of the best scientific schools in Great Britain. The medals and prizes offered by the City and Guilds of London Institute are open to the students.

The courses of instruction include nearly one hundred science and technical subjects, besides the classes in commercial subjects. Such courses as geology, botany, mineralogy, etc., are not within the scope of this inquiry, and are not here considered in detail.

The technical teaching in the school begins with a preliminary course arranged to meet the needs of students who are not sufficiently advanced to enter the technical departments. The more important trade and technical courses are as follows:

Plumbing: This course as provided in the day school is designed for youths who are preparing to follow the trade of a plumber, or for those who are already engaged in the business and desire special knowledge of the principles and practice of the trade. Taken in connection with sanitary engineering, the course prepares the student (male or female) for the work of factory or sanitary inspector. The course in the night school is intended to meet the requirements of apprentices and journeymen and master plumbers. It is further designed to afford instruction in the theory and practice of sanitary engineering. The full course covers two years, in both day and evening schools. Among the subjects included are workshop arithmetic, geometry,

and drawing; elementary physics for plumbers; alloys, solders, etc., their composition, properties, uses, and methods of practical use; physical and chemical properties and qualities of lead, tin, zinc, copper, brass, etc., and the various forms and special uses of these metals as applicable to plumbing; water supply, closets, baths, sinks, lavatories, drainage, etc.; traps, waste pipes, drains, tanks, etc.; external plumbers' work, cutting out sheet lead, lining cisterns; hot-water circulation, and the principles of hot-water heating; sanitation and ventilation, and tools used in plumbing. The practical work covers thoroughly all the important phases of the trade, and practical examinations are held to test the students' mechanical skill.

Bleaching, dyeing, and printing: This full course extends over three years, and is intended to give the sons of masters, managers, or foremen, or young men wishing to engage in the trade a sound elementary knowledge of the sciences, especially of general chemistry, which underlie the industry, and to train them to apply their knowledge with advantage and success. The first and second year's instruction is devoted to mathematics, organic and inorganic chemistry, chemical physics, qualitative and quantitative analysis, chemical preparations, German, and laboratory work. The work in chemistry is very thorough and comprehensive, and embraces in great minuteness the study of the constituent and generic properties of the various elements entering into the practical applications of the bleaching, dyeing, and printing trade. In the third year the study of chemistry is continued, and instruction is given in gas analysis and gas apparatus, the manufacture of sulphuric acid and alkali; electrolysis and electrolytic bleaching. The technology of textile fibers, natural and artificial coloring matters, and mordants are treated very exhaustively. It treats of the origin, chemical and microscopical character of fibers, the action of chemical agents upon them, the detection of mixed fabrics, and methods of bleaching; the various mordants and their action in dyeing, methods of testing mordants and their application to the different textile fibers; water suitable for dyeing and scouring, and thickeners, etc., used in printing and finishing; the origin, varieties, commercial preparation, and coloring principles of such natural coloring matters as logwood, brazil wood, corn wood, and allied redwoods, indigo, cochineal, madder, lacdye, safflower, catechu, fustic, weld, etc.; the application of these coloring matters to different fibers in dyeing and printing, and the shades produced by different mordants; the stability of the colors obtained, and methods of detecting the different coloring matters when dyed on the fiber; artificial coloring matters, especially the direct cotton, basic, and mordant colors with reference to their practical application in cotton dyeing and printing; the technology and chemistry of coal-tar colors, and the preparation, composition, and properties of artificial coloring matters in general. The experimental work in the dyeing laboratory is intended to acquaint the student with the bleaching of cotton, the uses of mordants, and the application in dyeing and printing of the natural and artificial coloring matters. The experiments are at first carried out on a small scale and are chiefly comparative, in order to accustom the student to neat and exact work and to enable him to study carefully the various conditions of time, temperature, etc., in mordanting and dyeing. Toward the end of the third year's course opportunity is offered for bleaching, dyeing, and printing on half-scale machinery.

The evening school offers a somewhat shorter course, and also affords opportunity for study in special subjects in the trade.

Silk manufacturing: This course embraces mathematical calculations, mechanics and engineering drawing, chemistry, weaving, throwing, free-hand drawing, designing and application of design to silk fabrics. Instruction in throwing includes origin and species of cultivated and wild silk-producing insects, properties of silk fibers, diseases of silkworms and their effects on the fibers and cocoons, the uses and comparative values of silks produced in different countries; reeling, winding, cleaning, throwing, carding, combing, and spinning waste silks; doubling and conditioning raw and thrown silks. Preparation includes winding, warping, beaming, dressing,

drawing in, twisting, and gaiting. Instruction in weaving embraces the construction of hand looms and the comparative merits of hand and power looms, the importance of the hand loom in silk manufacture, the adaptation of the power loom to the production of various fabrics, the application of design to fabrics, and the analysis of woven fabrics. The time devoted to lectures and practice is 35 hours per week, and nearly one-half of this time is given to practical work in chemistry and weaving. The work in chemistry has principally to do with dyeing.

Cotton spinning: The object of this course is to meet the requirements of overlookers, managers, manufacturers, and merchants. The course extends over three years. The lectures embrace the cultivation, picking, and preparation of the various kinds of cotton for the market; the value of cotton as determined by length, strength, diameter, and touch of fibers; the study of cottons grown in the different cotton-producing countries; mixing, cleaning, opening, and carding cotton, and the machines in use for these purposes; combing in all its phases, and combing machines; drawing, flyer, and mule frames, their use, action, and all their various attachments and complications; doubling, winding, and reeling, and the machinery used in these operations; conditioning and testing yarn; trade terms applied to yarn; the faults in yarn, their causes and remedies; the character and quantity of waste made in preparing and spinning cotton, and the utilization of waste, together with a knowledge of waste-spinning machinery; quantities of machinery required to produce yarn of a given count and quality; arrangement of machinery; calculations relating to all the operations in a spinning mill, and ventilating, lighting, heating, and humidifying mills. The practical work conducted during the entire course is very thorough, and includes setting and timing all the machines used in spinning and personally performing all operations in each process of manufacture. The course also includes one year's instruction in textile engineering.

Cotton weaving and designing: This course extends over three years, and is designed to meet the needs of overlookers, managers, manufacturers, and merchants. The lectures of the first year treat of the conditions in which yarns are supplied to the mills, the relative advantages of dyeing and bleaching in such conditions, and the processes through which warp and weft yarns pass in their preparation for the loom; winding, warping, and chaining; combined warping and sizing, dressing and slashing machinery, and hot-air drying; sizing in ball and hank, and sizing calculations; Yorkshire and Scotch dressing, winding on, drawing in, and twisting; looms—their various motions, and timing, setting, fixing, and gaiting them; designing cotton fabrics, and making calculations for reeds, healds, shrinkage, quantities of warp and weft, wages, and cost. The knowledge of preparation, weaving, mechanism, and calculations gained by students in the first year's work is so thorough that substantially all the time of the second and third years is devoted to designing and weaving. The instruction is in keeping with the advanced position occupied by the mills of this great cotton-manufacturing center, and embraces the designing and weaving of the varied assortment of high-class fabrics produced. Particular attention is given Jacquard machines and their work. No detail in cotton cloth manufacture is overlooked or treated lightly, and the course is exceptionally comprehensive and thorough. As in the case of spinning, textile engineering forms a conspicuous part of the course.

Typographic printing: Three separate courses of instruction are arranged for this subject. The first is for apprentices under 18 years of age, and is preliminary in character; the second is for apprentices and journeymen, and the third is for those who have passed the second course. The lectures in the preliminary course cover composition and machine and press work. They begin with the history of printing and the evolution of the printing press, and then take up such subjects as spelling, punctuation, casting up matter, classification of type, lay of cases, the art of composing, distribution, proof reading, imposing, jobbing work, sizes of paper, construction of presses, roller composition, casting and care of rollers, various printing machines;

half-tone, line, and three-color printing; motive power (steam, gas, and electric), printers' bookkeeping, etc. The second course enlarges upon the work of the first and considers typefounding, stereotyping, electrotyping, process blocking, book and news work, composing machines and general principles of composition, the more difficult schemes of imposition, job printing, and tabular work, manufacture of paper, etc. The third course continues along advanced lines the work of the second course, and in addition takes up foreign types; methods of ascertaining the weight of type, leads, etc., in a given piece of work; modern labor-saving appliances in all departments of printing, including the linotype machine; bronze and leaf-metal printing; inks, zincography, sizes, qualities, and general treatment of papers; mill, straw, and leather boards; estimating, and general office management.

Lithographic and analogous methods of printing: This course is intended for first, second, and third year apprentices. The course of instruction embraces the consideration of the geological character and chemical composition of lithographic stone; the properties of such materials as acids, gums, resin, wax, varnishes, etc.; the hand press and lithographic machines; the source and manufacture of color; the nature, composition, and manufacture of varnishes, inks, and dryers; engraving on stone, transposition, chromolithography, patching and shining up color work, zincography, albuminography, copperplate engraving, etching, mezzotint work, and copperplate printing, graduated tint printing, decalcomanie transfer printing, autographic printing methods, wood engraving, woodburytype, photogravure, fabric printing, photolithography; bronze, metal, and colored dust work; luminous printing and transposition work; methods of estimating, management, and such other matters as relate to special branches of the trade. The lectures are fully illustrated, as far as practicable, by work executed before the students. The classes are equipped with presses and materials for the demonstration of practical work.

Flour manufacture: The course comprises thirty lectures, beginning with the abstract principles of milling, and taking up in order the constituents of grains and the principal varieties of wheat; handling and storing, cleaning and preparing, and mixing wheat; methods of grinding, sieving, purifying, and reducing, and the machinery used in these operations; flour dressing, milling economics, the designing of mill plants, arrangement of mills and milling machinery, motive power, millwrighting, hygienic considerations in mills, and causes of fire, precautions against the same, and extinguishing appliances. The lectures are illustrated by diagrams, lantern slides, samples, and models.

Horseshoeing: This course consists of lectures on the principles of shoeing, the anatomy and physiology of the horse's foot, care of the foot, diseases of the foot, pathological shoeing, and the various details in expert work, such as heel shoeing, etc. The practical work comprises the preparation of the foot and making, fitting, and putting on the shoe. At the end of the course an examination is held, and those who pass it successfully are entitled to be enrolled on the register of the Worshipful Company of Farriers.

Dressmaking and millinery: The course in dressmaking comprises cutting, fitting, and making up all kinds of ladies' and children's garments, dresses, mantles, underclothing, etc., and therefore prepares students for the examinations of the City and Guilds of London Institute. The course in millinery embraces the making and trimming of hats, caps, and bonnets in the best styles and taste, including children's millinery and the management of velvet, straw, lace, tulle, etc., in millinery.

Architecture and electrical and mechanical engineering are taught very thoroughly, including the necessary shop practice in wood and iron work. There is a special course in chemistry for brewers, and telegraphy, telephony, and other commercial subjects are well provided for. In fact, there is scarcely a mechanical or commercial occu-

pation connected with the industries of the city in which instruction more or less complete is not given.

The school is governed by a committee of 36 members, 24 of whom are members of the city council, and the other 12 are men interested in the progress of commerce and manufactures.

A large corps of efficient instructors compose the teaching staff. About 4,000 students attend the evening classes and 150 the day classes.

The entire institution in all its departments occupies nine buildings. The principal building is that for the technical department and cost, including equipment, about £125,000 ($608,313). A new building is in contemplation, which, with its equipment, will cost some £200,000 ($973,300), besides £60,000 ($291,990) for the land.

The school has been instrumental in promoting and increasing the general efficiency and intelligence of the working classes, and the general benefits accruing to the local industries are evidenced by the growing readiness of large business establishments to give substantial aid in bearing its financial burdens. Former students are required to serve apprenticeships, but they rapidly rise to good paying positions. The management has every reason to be satisfied with the past work of the school.

DURHAM COLLEGE OF SCIENCE, NEWCASTLE-UPON-TYNE.

This institution was established in 1871, and is devoted to the study and advancement of science, philosophy, literature, and the fine and mechanical arts, or other kindred branches of learning. No attempt is made at trade teaching, but evening classes provide technical instruction useful to craftsmen and others in a few occupations.

There is a course in carriage building, which embraces free-hand and scale drawing, the nature and properties of materials, the general principles of carriage design, the mechanical principles that should guide carriage builders as regards wheels, springs, etc., general instruction in the different branches of carriage manufacture, labor-saving machinery, and methods of planning, etc., together with advanced instruction in the whole art of the trade.

Classes in plumbing are conducted in connection with the Worshipful Company of Plumbers of the city of London, and the instruction embraces such theoretical and practical training as to prepare students for recognition by the district council for the registration of plumbers.

Classes in typography receive instruction in composing, and press and machine work designed to fit students for the examinations of the City and Guilds of London Institute. The classes are associated with the Newcastle-upon-Tyne and District Typographia and Guild of Allied Trades, and are superintended by a committee of that society.

NORTHAMPTON AND COUNTY TECHNICAL INSTITUTE, NORTHAMPTON.

This school was opened in 1894. The board of governors is composed of 7 representatives from the county, 6 representatives from the general charities committee, 5 members of the town council, 2 members of the school board, and 2 cooptative members.

The school is divided into three departments, as follows:

Junior school for boys from 9 to 13 years of age: The subjects taught are English, Latin, French, arithmetic, history, geography, writing, drawing, and the elements of natural science. Special attention is paid to the groundwork of a good English education, including writing, arithmetic, and drawing. To be admitted a boy must pass an examination in reading, writing, dictation, and the first four rules of arithmetic. Boys are admitted as soon as they have attained the age of 9 years.

Senior school—Classical side: This prepares for the learned professions and for the universities. The subjects of instruction are Latin, Greek, French, English, history, geography, arithmetic and mathematics, drawing, and some natural science.

Senior school—Modern side: This prepares for commercial life, the civil service, and manufacturing. The subjects of instruction are French, English, shorthand, bookkeeping, drawing, arithmetic and mathematics, history and commercial geography, natural science, including chemistry, with practical work in the laboratory, light, heat, electricity, mechanics, and also elementary Latin.

On Saturday mornings special classes are held for students who are backward, or for those preparing for special examinations. There is no extra fee for these.

The fee for any subject (except art) is 5s. ($1.22) per session (September to May), and students can compound any number of science and technological subjects by paying a fee of £1 ($4.87). The fees in the art department range from 5s. to 10s. ($1.22 to $2.43) per year.

Plumbing is the chief trade taught. The primary class is confined to apprentices, and the intermediate and final classes to those at work in the trade. The primary course embraces workshop arithmetic, density of materials, geometry as applicable to plumbing, reading working drawings and making rough dimension sketches of apparatus and plumbers' work; mechanics, hydrostatics, heat, and chemistry in their relations to plumbing; the equipment of the workshop, tools, the manufacture of sheet lead, pipes, etc., and marking off simple work in sheet lead, and workshop practice.

The intermediate course embraces elasticity and strength of materials, the flow of solids, testing, etc.; expansion of gases, laws of expansion, radiation, hot-water heating, etc.; electricity in its application to plumbing, as how to prevent electrolysis, fixing bells, and

dealing with light conductors and fittings; the manufacture of traps and other appliances, roof and general lead work, and a continuation of drawing and shop practice.

The final course treats of hydraulics in all its applications to the plumbing trade, building construction with especial reference to roofs, sanitation of buildings and general sanitary arrangements, general high-class plumbing, and difficult practical work in the shop.

The course in boot and shoe manufacture is the same as that of the Wellingborough classes, and is conducted by the same instructor.

The tanning course includes the tanning of hides and the dressing of heavy leather. The lectures treat of hides and skins, their treatment preparatory to tanning, and the theory of the tanning process, the materials employed in tawing and tanning, the practical details of tanning methods in general use, drying appliances, drying various leathers, finishing sole leather, currying, and the utilization of refuse.

The subject of carpentry embraces a class for lectures, with practical demonstrations, on the methods of constructing staircases and hand railings. This class is useful for all desiring to become staircase hands, foremen, etc. There is also a class in carpentry and joinery, in which are treated such subjects as timber, its growth, seasoning, utility, etc., floors and roofs of various kinds, and the various kinds of doors, frames, and arches.

In the art department are classes in general drawing, drawing the human figure, decoration, architecture, painting, and modeling. The primary intention of this department is not only to teach pure art, but its practical application as well. The usual commercial subjects are taught in the commercial department.

The work of the school has been satisfactory and has met with encouragement from the employing public. General benefits have come to the community by increased efficiency and intelligence among the working classes.

NORTHAMPTON COUNTY COUNCIL SCHOOLS, NORTHAMPTON AND NORTHAMPTONSHIRE.

These schools are operated under the local taxation (customs and excises) act of 1890. The schools began operations in 1892, and the money devoted to them is all received from the Government under the above act, and no part of it from the rates provided for in the technical instruction act of 1889. The work is in the hands of the county educational committee, and they arranged to supply and aid technical instruction during the year 1900-01 in the following manner:

Single lectures or short courses on dairying, treatment of farm animals in health and disease, farriery, gardening, poultry keeping, and bee keeping.

By contributing to the Cambridge University department of agriculture.

By providing teachers for classes in dress cutting, under-linen cutting, manual training in woodwork and wood carving, and the principles of boot and shoe manufacture.

By providing (in conjunction with the governors of Northampton and County Modern and Technical School) special Saturday classes in science, art, and modern languages for elementary school-teachers.

By making allowances toward the traveling expenses of elementary school-teachers attending Saturday classes and other approved science and art classes.

By making capitation and other grants to committees of science and art classes recognized by the board of education, South Kensington; to managers of evening continuation schools recognized by the board of education, Whitehall, S. W., in which elementary subjects are taught; and to committees of ambulance classes conducted in accordance with the regulations of the St. John Ambulance Association.

By providing scholarships, tenable for two years, to enable boys and girls to attend approved secondary schools.

By providing free studentships, tenable for eight months, at the County Council School of Domestic Economy, Northampton; and one-month studentships at approved dairy institutes. And also by providing books to be sent on loan to local committees.

In 1899 lectures were given at convenient centers throughout the county as follows: On animal, farm, and garden subjects in 62 localities, on boot and shoe manufacture in 7 localities, on woodwork and wood carving in 10 localities, on science and art in 9 localities, and on dressmaking in 7 localities. Besides this, aid was given in teaching various subjects in 25 centers throughout the county. The instruction varied from one lecture to a series of six or more, according to circumstances.

The most important subject treated is that of boot and shoe manufacture. This is the staple trade of the county, and is largely carried on in villages and small towns scattered over a wide area, and in most cases in places where the ordinary apparatus for teaching specialized subjects is not available. Therefore, the conditions under which instruction can be given differ widely from those possible in well-equipped institutions. The two most important classes in this subject are conducted at Kettering and Wellingborough. Following is an outline of the Wellingborough course:

Taking measures, fitting up lasts, etc.; principles of last making; designing and cutting patterns for uppers; clicking; the best methods of preparing uppers for the sewing machine; ranging, cutting, and sorting bottom stock; riveting, pegging, and screwing by hand and machine; hand and machine sewing—channel sewing, fair stitching, making turned shoes, welts, etc.; heel building; finishing; the principles of lasting and finishing machines; the study of raw materials; processes

of tanning, currying, etc.; and the arrangement and regulation of the various departments of a manufactory. Students who attend the lectures regularly are admitted to the school workshop for practice.

Instruction is also given in such practical subjects as horseshoeing, dressmaking, lace making, woodworking, and domestic subjects.

The chief lecturer on boot and shoe manufacture has had thirty years' practical experience, and he has 9 assistants who have been similarly trained.

The inspector from the City and Guilds of London Institute, in speaking of the boot and shoe schools of the county, says: "The work that is being done is by no means limited to the class rooms. * * * It is far-reaching in its effect, and has a decided influence upon the trade of the district."

The work of the schools has been eminently satisfactory. A great proportion of those who have taken the course are well employed and they are far better off than are those who have not taken the course. A London firm recently advertising for clickers specified, "Students from Northamptonshire technical schools preferred." Of the 33 medals and prizes offered for competition to the whole United Kingdom during the past few years by the City and Guilds of London Institute 25 have been secured by Northamptonshire students.

In the year 1900 the committee had at its disposal £7,500 ($36,499).

UNIVERSITY COLLEGE, NOTTINGHAM.

This college has been open about eight years. Its object is primarily to afford general scientific instruction, but provision is also made in evening classes for technical teaching in certain trades.

Both boys and girls are admitted to the college classes. Day students must be 16 years of age, and evening students must be not under 14 years of age and have reached a stage of advancement equivalent to the sixth standard of the Government code. The usual fee for each course in evening technical classes is 5s. ($1.22).

The day courses include engineering, architecture, chemistry, pharmacy, mining, commerce, language and literature, and a number of scientific subjects.

The courses of instruction in the evening technical classes are arranged to meet the requirements of apprentices, workmen, journeymen, foremen, architects, and draftsmen who are engaged during the day in industrial pursuits, or other persons who are preparing for such pursuits.

The work in the course of mechanical drawing and design begins with tracing, working drawings, and machine details, and then takes up original drawings and the simpler details of design.

The carpentry and joinery course includes instruction in technical drawing and in setting out work, and such practical exercises as will acquaint the student with the ordinary details of the trade. The

ground covered by the course is such as to meet the requirements of the City and Guilds of London Institute examinations.

The class in metal working is intended to help such persons as turners and fitters who use metal-working tools. Instruction is given in forge work and tool making, setting out work for machine tools, speeding and feeding machines, and practical work in brass turning, screwing, and finishing.

In plumbing the course is intended to prepare students to become registered plumbers under the scheme of the Worshipful Company of Plumbers, London. The instruction is in accord with the syllabus of the City and Guilds of London Institute and prepares students for those examinations. The subjects covered are principles of plumbing, technical drawing and setting out, properties of metals, solders, and alloys, action of gas and water on pipes, and practical instruction in the workshop.

Instruction in hosiery manufacture extends over a series of thirty lectures covering the general construction of textile fabrics, the formation of stitches in knitted and looped fabrics, the construction and action of various knitting frames and looms, numbering yarns, glove manufacture, trimming and finishing, and the chemistry of dyeing. Practical demonstrations are given of the various methods used in making framework knitted fabrics.

The subject of lace manufacture is treated with a regular course of thirty lectures, but special classes are arranged for students who have not the time to take the full course. The instruction embraces the describing of real lace and imitations, methods and materials used in the production of real lace, a study of the different lace machines and the laces produced on each machine, calculations and the details of lace manufacture. Practical work is provided to demonstrate the processes of manufacture.

Besides the above outlined courses, there are short special courses of lectures in applied chemistry for dyers, plumbers, and brewers, and also for persons engaged in the building trades and architecture, and for pattern makers, molders, and machinists.

The college is governed by a committee composed of representatives from the town council, from the universities of Cambridge and Oxford, and four citizens of the town. In 1901 there were 104 students in practical woodwork, 50 in plumbing, 19 in hosiery, 11 in lace, and 19 in metal-working tools.

The school has increased intelligence and efficiency among the working classes and has been of general benefit to the industries of the community.

Artisan trade organizations have the privilege of filling trade classes before outsiders are admitted, and they take advantage of the evening classes in large numbers.

Local firms aided in the equipping of the technical schools, and offer prizes in many subjects. Electrical-engineering firms show their appreciation of the work done in their line by sending articled students and apprentices to the classes.

The school work does not relieve students from apprenticeship, but it has led to better training in the shops and has enabled them to obtain better wages.

OLDHAM MUTUAL TECHNICAL SCHOOL, OLDHAM.

In 1884 a school for technical education on the principles of self-help originated in the minds of a number of students of the cotton classes formerly held at Rock Street School. The classes were held in the winter months only, but thirty of the students, considering the summer vacation a loss of valuable time, formed the Oldham mutual cotton class and met once a week all the year round. At these meetings they discussed subjects picked at random from the whole process of cotton spinning.

In 1886 they sought diagrams and illustrations to assist in their studies, and succeeded in procuring some from firms engaged in the manufacture of spinning machinery. These firms also sent their representatives to lecture on sectional parts of machinery. The organization then began to purchase standard works and to pay visits to cotton mills and other manufactories. The next step was to obtain larger quarters and to procure some machinery for use in the classes, and in 1891 success crowned these efforts. The building used was the property of the Oldham corporation, and in 1898 they were served with notice to quit. Again new quarters were looked for, and through the generosity of a local architect the present well-equipped premises was found and occupied in 1899.

The stated object of the society is to promote the study of literature, science, and the fine arts, and all moneys coming into its treasury are applied to this purpose.

Every candidate for membership must be proposed and seconded by two ordinary members. The entrance fee is 10s. ($2.43), which includes the current month's subscription. Every candidate appears (if necessary) before an investigating committee. The subscription fee for ordinary members is 2s. (49 cents) monthly.

The members meet every Thursday evening at 7.30 for lecture and discussion. The machinery is in motion every Tuesday and Friday evening from 7.30 to 9 o'clock.

There is no prescribed course of instruction; the system is chiefly one of self-instruction, and miscellaneous subjects are taken up at random. In 1900 the following subjects were discussed:

Spindles and their uses; flyer frames; Hetherington's mule; calculations; Asa's mule; Brook's ring frame; Howard & Bullough's slubber;

Asa's roving frame; setting points—Platt's mule; setting points—Asa's mule; points in mule spinning; intermediate frame; roving frame; Platt's cam shaft; copping; Platt's fine mule; mule backing-off and taking-in; Howard & Bullough's card; Parr Curtis mule; calculations—card-room machinery; drawing frame; mule sector; levers; Hetherington's cam shaft; mule backing-off; Green's economizers; copping; differential motion; reversing and tapering motion; engineering; scutching; mule quadrant; Platt's automatic nosing motion; ring spinning; winding on the mule; flat card.

There are at present about 120 members of the society. There are no teachers and there is no course of instruction; neither are there any examinations. It is a unique plan for obtaining technical instruction. As heretofore stated, the machinery is run two nights in the week, and members attend as they see fit. They stand about the room or follow the machines, and discuss with each other the various subjects suggested at the time. If a member comes across a knotty problem in his daily work, or in his studies, he introduces the matter to some one of the group of members and the problem is discussed. The scheme has proved of great advantage to the members, and many of them now occupy positions as foremen, etc., due in large measure, if not entirely, to the knowledge gained in the meetings of the society.

MUNICIPAL TECHNICAL SCHOOLS, OLDHAM.

As far back as 1839 science and art classes were commenced in Oldham, in connection with the Oldham Lyceum. Following this the Oldham School of Science and Art was opened in 1865, and in 1881 a handsome new building was added. The Oldham corporation decided to exercise the powers granted by the act of 1889, and in 1892 the school property was transferred to them with a view to its becoming the nucleus of the contemplated municipal technical schools. Final steps toward giving trade and technical instruction were taken in 1895, and in 1897 practical work began in the new school.

The science and technological departments afford facilities for obtaining instruction in the practical application of scientific principles to trades and industries. For this purpose there is a good equipment in laboratory and workshop. Students are advised to take up a regular course, but are at liberty to make their own choice of subjects. The number of subjects allowed to be taken up depends upon the time the students may have to devote to study.

The fees in the technological department range from 7s. 6d. to 10s. 6d. ($1.83 to $2.56) per session. A number of competitive scholarships, exhibitions, and prizes, ranging in value from 5s. to £50 ($1.22 to $243) are open to students upon conditions set forth in the prospectus of the schools.

The courses of instruction embrace such scientific subjects as mathematics, machine construction and drawing, building construction,

mechanics, physics, and chemistry; such art subjects as drawing, painting, modeling, and decorative design; commercial and domestic subjects and technological classes. The more important technical classes are a three years' course in cotton spinning, and courses in cotton weaving, plumbing, carpentry and joinery, and in dressmaking and millinery. The engineering courses cover the usual ground and are very thorough and practical.

The schools are managed by a technical instruction committee composed of the mayor and members of the town council. There are 8 instructors in the technological department. The schools are conducted in a splendid fireproof building erected with a view of meeting the demands of an all-round modern institution. The building cost about £12,000 ($58,398) not including the cost of equipment.

The work of the schools has been satisfactory to all concerned. One of the evidences of the high regard in which it is held by employers is the fact that the equipment of the spinning and weaving schools was donated by one firm.

HARRIS INSTITUTE, PRESTON.

Harris Institute, Preston, was originally a mechanics' institution, founded in 1828, and known as the "Preston Institution for the Diffusion of Knowledge." For many years classes were held in connection with the science and art department with a fair degree of success, but it was not until 1882, when the institution received, in the form of a bequest, the sum of £40,000 ($194,660) for the purpose of establishing and maintaining an "institute of literature, art, science, and technical education," that the rapid development of the work of the institute took place. In 1887 the trustees of the original fund made a further grant of £30,000 ($145,995). A supplemental scheme was framed for the application of the fund, and under its provisions £10,000 ($48,665) was applied toward building and furnishing a technical school, the remaining £20,000 ($97,330) being added to the endowment fund. In accordance with the scheme, "not less than one-eighth of the income has to be applied toward the payment of scholarships and exhibitions." This provision has proved of great service to the institute, the benefit derived from this separate fund being greatly appreciated by the students, many of whom, by obtaining scholarships from year to year, receive all their education free.

The managing council has power to grant two scholarships of the annual value of not less than £45 ($219) each, to be awarded on competitive examination, open to all students who have been attending the classes for not less than two years immediately preceding the examination, and tenable at any college or place of higher education.

The classes are broadly divisible into scientific and technical, the former following closely the syllabus laid down by the department of

science and art, and at the same time furnishing an adequate course for those who wish to read for a university scholarship or for a degree. The latter embrace more particularly the practical applications of the principles dealt with in the theoretical classes. They do not pretend to be a substitute for practical work or apprenticeship, but aim to render clear many points of doubt and difficulty which arise in the mind of an intelligent and painstaking workman. While there is no compulsory course of instruction laid down, students are strongly advised to take up one of the organized courses, in order that a definite and continuous training may be insured. These courses are carefully graded and so arranged that each year's work leads up naturally to the work of the succeeding year. The courses may, with the consent of the principal, be modified to suit particular cases.

The work of the institute is divided among 12 departments, as follows: Mathematics, chemistry and physics, engineering, natural science, building trades, spinning and weaving, art, commercial (including modern languages), agriculture, teaching, domestic economy, and miscellaneous. The department of agriculture, which is in connection with the Lancashire County Council, affords theoretical and practical instruction to a large class of students who are drawn from all parts of the county. The work of this school is designed to be thorough in every particular, two days each week being devoted to practical and experimental work on near-by farms. The professor in veterinary science likewise avails himself of opportunities for demonstrating the practical part of his subject. In addition to free tuition, the county council allows a sum, not exceeding 10 shillings ($2.43) per week, either for board and lodging or for traveling expenses, to each student who fulfills the conditions laid down.

The school year begins the middle of September and closes in May, except in the art school, which has a summer term ending the middle of July. Evening sessions are the rule, though in the schools of domestic economy, agriculture, and art, and in the teachers' classes, day sessions are also held.

The organized courses of instruction, which require three years for completion, include mechanical and electrical engineering, pattern making, carpentry and joinery, brickwork and masonry, cabinetmaking, plumbing, cotton spinning and weaving, agriculture, courses for iron and brass founders, soap makers, etc. The school of domestic economy has diploma courses in laundry work, cookery, dressmaking, and millinery, which require from one to two years for completion, and technical courses in the same branches, which are limited to twenty lessons in elementary and advanced work. The art school provides instruction in the principles and practice of art as applied in the form of design to manufactures and industrial occupations generally. It also deals with decorative and pictorial branches and furnishes a

methodical course of study for art workmen. Due consideration is given to the special requirements of students depending on their daily occupations.

The institute is managed by a president and governing council. The faculty consists of about 40 instructors, a large number of whom have obtained college degrees.

Of the 2,844 students, the average attendance in April, 1899, the art school had 261 and the technical school 147, as follows: Art school—day classes 14, evening classes 179, modeling class 13, elementary class 45, technical design 10; technical school—brickwork and masonry 10, carpentry and joinery 21, cabinetmaking 5, electric lighting 6, plumbing 14, wood carving 5, cotton spinning 33, weaving and designing 53.

The cost of maintenance is approximately £6,000 ($29,199) per annum. The funds for erecting and equipping the school were provided by endowments, grants, and contributions. The revenue of the institute is derived from interest on endowments, grants from the county council of Lancashire and the corporation of Preston, and tuition fees.

Regarding the courses of training and study, it is said that they are satisfactory in every respect. The industrial benefits which have been gained from the establishment of the institute are of a general character. The manufacture of cotton goods is the leading industry of the locality, and the usefulness of the institute and the benefits accruing from its system of instruction, especially in the cotton spinning and weaving department, are well attested by the favorable attitude of the local manufacturers, one large firm with 7,000 employees having paid the tuition fees of 500 students in a recent year. The institute has exerted a strong influence toward increasing the intelligence and efficiency of the working classes in the community. It is stated that the effect upon those who have been under instruction has been in every respect gratifying to the management. The annual report refers to numerous instances where former students in the technical or trade classes have met with remarkable success since leaving the institute. Many of them are now holding important positions in large industrial establishments in the immediate vicinity and in distant cities and towns. Most of the employing carpenters in Preston encourage the attendance of apprentices, and a number of them pay their tuition fees, while some of the leading architects require their office help to attend the classes in building construction. It is stated, also, that the success of the institute has led to the improvement of shop training in the locality. Referring to the possibility of graduates obtaining employment without serving a period of apprenticeship, it is said that while apprentices, by the aid of the evening classes, can learn in four years what previously required five, still no allowance is made and they must continue their apprenticeship to the usual age.

MUNICIPAL TECHNICAL SCHOOL, ROCHDALE.

The Municipal Technical School of Rochdale was established about the year 1887 and is the outcome of subscriptions raised in the jubilee year. Like most schools of this class, the earlier years of its career were marked by a slow, though steady, growth, both in respect to the interest manifested by the class of students it aimed to reach and the efficiency of its courses and methods of training. In 1893 a handsome modern school building, which, together with the equipment, cost approximately £12,000 ($58,398), was erected, and since then there has been a large increase in the attendance, especially noticeable in the classes having subjects allied to the industries of the town, such as spinning, weaving, dyeing, and the engineering and building trades.

Though organized as a municipal institution, the school is also open to students who reside outside the borough of Rochdale. During the past session 267 of these outside students, making 462 separate class entries, attended the school. The Lancashire County Council makes a grant to the school for each outside student who attends for advanced instruction in science or technology. This grant, however, is not available for students in art or elementary subjects. In most cases the rail or tram fare of students from outside the borough is remitted by their district councils.

The prospectus contains the following regarding the object of the school:

The aim of the committee in arranging the work of the technical school is to provide systematic instruction in the scientific principles applicable to the leading trades and industries of Rochdale and the district.

The classes are intended principally for those who, being engaged in industrial and commercial occupations in the daytime, desire to receive supplementary instruction in the application of science and of art to the trades and manufactures in which they are interested.

The instruction given in the school is intended to supplement and develop, and not to supersede, the knowledge gained by practical experience in the workshop or factory. Trades can not be taught in the technical school; the necessary manual skill can only come after long practice in the workshop.

The main object of the instruction is to provide a thorough knowledge of the scientific principles underlying the daily work of the student, so as to enable him to take that intelligent interest in his work which is essential to success.

Among the interesting features connected with the school are the students' associations, which have been promoted by the older students for their own advancement. The first of these—the Cotton Spinning Mutual Improvement Society—was formed in 1897. Its object is the attainment of a more technical knowledge of the various machines in the cotton industry and the provision of facilities for the members

to familiarize themselves with the various parts and motions of such machinery. There is also an association among the advanced and honor grade students in the building-trades classes which is designed to supplement the theoretical knowledge gained in the school by visits to quarries, brickyards, and workshops and to buildings in course of erection. Meetings are also held in the technical school, at which papers are read on matters not fully dealt with in the ordinary school course.

Students are not compelled to attend any definite course of instruction: they are free to select those subjects which are best adapted to assist them in their particular trade or business, but before joining any of the classes they must satisfy the teachers or the secretary that they are qualified to benefit by the instruction given. The school year opens the middle of September and closes the middle of May, except for the art classes, which close in July. Besides the evening sessions, which are held in all departments, there are also day classes in domestic economy, art, telegraphy and telephony, and in chemistry. All classes except the special classes for women are open to students of either sex. Those in attendance at a day school and persons under 12 years of age are not admitted. A small tuition fee is charged.

The classes in the school may be broadly divided into two groups. The first group comprises technical subjects. Most of these bear directly upon the industries of the district. In them the scientific principles upon which the various industrial processes depend are fully explained, and in several branches a course of practical training is provided. The second group comprises scientific subjects and modern languages. The courses in the science classes follow closely the syllabus of the board of education, and are also suitable for students preparing for university degrees or scholarships. The work is not restricted to industrial applications, but deals also with theoretical principles and pure science.

The subjects in detail are as follows: Weaving and designing; cotton, wool, and worsted spinning; chemistry; dyeing and bleaching; magnetism and electricity; telegraphy and telephony; electric lighting; machine construction; applied mechanics; steam; pattern making; coloring and sketching; manual training in woodwork; building construction; carpentry and joinery; builders' quantities; plumbing; practical, plane, and solid geometry; mathematics; natural science; domestic economy, including dressmaking, needlework, millinery, cookery, and laundry work; commercial classes; and art classes.

The object of the art school is to provide, by suitable courses of study, a thoroughly practical knowledge of designing, drawing, painting, and modeling, with special regard to their various applications to the building trades, architecture, pattern designing for wall papers, paints, textile fabrics, etc., painting and decorating, lithography, etc.

The school is managed by a committee of 24, consisting of the mayor, 3 aldermen, 10 councilors who are appointed by the town council, and 10 other citizens who are appointed by the original subscribers. There are 50 instructors, 25 of whom are engaged in the art, trade, and technical courses. Most of the instructors have had practical as well as theoretical training, and those in the evening classes are actually engaged in the trades during the day.

Of the 2,611 students entering the school for the year 1900–01, there were 1,826 who attended up to the end of the school year. Of this latter number, 754 students were distributed among the technical, trade, and art classes, as follows: Weaving and designing, 54; cotton, wool, and worsted spinning, 44; plumbing, 97; carpentry and joinery, 55; building construction, 85; builders' quantities, 12; pattern making, 11; inking and coloring, 10; electric lighting, 8; telegraphy and telephony, 12; cotton, wool, and silk dyeing, 13; dyeing and bleaching, 9; art classes, 344. The revenue of the school is derived mainly from Government grants; local taxation (customs and excise); rate aid, 1d. (2 cents) in the £1 ($4.87), and tuition fees. The cost of maintenance for the year ending March 31, 1901, was £4,760 ($23,165).

The influence that the school has had upon the local industries is difficult to trace, but it is thought that it has helped to increase the variety of weaving in the local textile industry. The work of the school has resulted in increasing the intelligence and efficiency of the working classes generally.

Local labor unions take a friendly interest in the school, and there has always been one or more active trade unionists on the council committee. Practical plumbing classes are limited by the desire of the master plumbers to admit only those who are workers at the trade. Here, as in other places, the master plumbers give prizes to the students. If a student migrates, at the age of 18, in order to get better wages, the unions do not object unless he claims full journeymen's wages. The effect upon those who have been under instruction has been beneficial in every respect, and as a rule they have received better positions and higher wages than they would otherwise have obtained. Graduates are required to undergo the usual period of apprenticeship before engaging as full-fledged journeymen. While there is nothing positive regarding the attitude of employers in giving preference to graduates, there is ample evidence that they desire their employees to take advantage of the facilities afforded by the evening classes. One large engineering firm offers prizes to apprentices who attend the school, and many other employers pay the tuition fees of their workmen. In the opinion of the officials, the success of the school has led to the improvement of shop training in the vicinity.

ROYAL TECHNICAL INSTITUTE, SALFORD.

The Royal Technical Institute was established to provide for the county borough of Salford systematic instruction in those branches of knowledge which have a direct bearing upon the leading industries of the district.

A few months after the passing of the technical-instruction act in 1889 a committee was appointed to consider the question of technical instruction within the borough. The recommendation of the committee to establish a technical school was adopted by the council in 1890, and a plot of land adjoining Peel Park, belonging to the corporation, was fixed on as a site for the proposed school. The building was opened March 25, 1896, and the institute commenced teaching operations in September, 1896.

The amount sanctioned by the local government board to be borrowed for the erection and equipment of the building amounted to £68,500 ($333,355). The total cost of the building was £61,000 ($296,857), and the furnishing and equipment have amounted to a little over £20,000 ($97,330), making a total of £81,000 ($394,187); the difference between the amount borrowed and the total cost of building and equipment was met by the large donations of money and machinery which were presented by the leading manufacturers and inhabitants of the borough. The annual income of the institute exceeds £9,500 ($46,232).

The building is of red Ruabon brick, roofed with red tiles, the facings, moldings, and ornaments being of red terra cotta; it is about 311 feet in length, and its height to the central gable is a little over 100 feet. There are four stories. The style of architecture is Renaissance.

In the borough of Salford are extensive mechanical and electrical engineering works, chemical works, cotton mills, dyeing and calico printing works, and a large number of smaller but still important industries. The instruction provided in the institute has a direct bearing upon these industries, and is to a large extent practical, the main purpose being to teach the application of the principles of science and art to such trades and industries. The courses are divided into day classes and evening classes.

Day students are not admitted, unless in exceptional circumstances, under 15 years of age. They are expected to follow one of the organized courses of instruction, which extend over two or three years. The course of study for the first year is the same for all departments, and includes instruction in mathematics, theoretical mechanics, physics, chemistry, drawing, French, German, and workshop practice. The second and third year courses become specialized according to the department the student proposes to enter. These courses are arranged under the following departments: Mechanical engineering; physics

and electrical engineering; chemistry; dyeing, bleaching, and calico printing; the building trades, and art. The fees range from 5 to 9 guineas ($25.55 to $45.99) per session.

The evening classes are intended for those who are engaged in industrial or commercial pursuits in the daytime, and who desire to receive supplementary instruction in the application of science or of art to the trades or manufactures in which they are concerned. Courses of instruction, extending over four years, have been arranged with regard to the chief industries of the district. One of the main features of the evening classes is that laboratory instruction is insisted on in all the advanced classes, and a student is allowed, by special permission only, to take up a lecture course without the corresponding practical class.

The institute embraces the following departments: Mathematics (pure and applied); mechanical engineering; applied physics and electrical engineering; chemistry and metallurgy; dyeing, calico printing, and bleaching; the building trades, including sanitary engineering and plumbing; cotton spinning and weaving; domestic, including cookery, dressmaking, laundry, and millinery; hygiene and physiology; modern languages; school of art.

The department of dyeing and calico printing is provided with a lecture theater, large experimental dyehouse, and a large calico printing laboratory. There is also a balance and burette room. The dyehouse is fitted with dye tables, giving accommodation for about 30 students working at one time. These tables are arranged with ten sets of six dye pots. The pots are placed in glycerin, which is heated by steam under pressure. The tables are also provided with hot and cold water. At the end of the dyehouse there is a set of six color pans, heated by steam, and also drying ovens. Included in the equipment are large dye jigs, which are driven by power, and arranged so that full-width cloth can be dyed. Directly under the dyehouse is the calico-printing laboratory, replete with the most modern and full-sized printing machines, including a full-width sample-printing machine, a single-color sample-printing machine, a two-color sample-printing machine, an aging machine, hot-air drying and padding machine, steaming cottage, and a range of color-mixing pans. These machines are driven by means of a 7-horsepower alternating-current motor. The course of instruction covers three years, and is intended to give students desirous of obtaining positions in dyeing, printing, or bleaching works a thoroughly scientific and practical training in those branches of knowledge which underlie these industries. Lectures are given on dyeing and calico printing, bleaching, coal-tar coloring matters, etc. The experimental work is intended to give students a thorough knowledge of the processes of bleaching, dyeing, and printing, the uses of mordants and their application in dyeing and printing, with the various natural and artificial coloring matters.

Practice is given in determining the commercial value of dye wares, in the detection of the nature of the coloring matters on dyed fabrics, and in color matching.

In the building trades department courses have been arranged to meet the requirements of artisans belonging to the building trades. The lectures include geometry, building construction and drawing, carpentry and joinery, masonry, brickwork, house painting and decorators' work, plumbing, and sanitary science. The course in building construction and drawing comprises the setting out of all branches of builders' work, so that artisans not only learn to understand a sketch, but also how to set out working diagrams, etc., from drawings and written information. Students are taught to draw to scale from sketches and models of builders' work. The syllabus of the lectures on carpentry and joinery and masonry and brickwork are similar to those set forth in the programme of the City and Guilds of London Institute. In house painters' and decorators' work the course of instruction consists of lectures and practical work. The lectures are fully illustrated by designs, drawings, etc. The plumbing classes are arranged to meet the requirements of apprentices and others who desire to obtain a sound knowledge of the principles of their trade. They are also suitable for those sitting for the certificate of the Sanitary Institute of Great Britain and for other examinations in sanitary science.

The accommodation provided in the department consists of 2 lecture rooms, a large drawing office for about 60 students, a woodwork shop, 2 rooms for practical plumbing, and 2 rooms for painters' and decorators' work. The woodworking shop contains 20 benches, 2 wood-turning lathes, band saw, circular saw, and grindstone, the whole being driven by means of an electric motor. The instruction consists of exercises in the use of tools, in the making of joints, hand railings, etc. Instruction is also given in wood turning. The plumbers' shops are provided with all kinds of appliances necessary for complete instruction in practical plumbing. Instruction is given in the use of tools, preparation of solder, soil, etc.; in marking and cutting out sheet lead; in jointing and bending lead pipe of all diameters, and in making expansion joints, etc. The house painters' and decorators' workshops are well equipped with all kinds of tools, materials, and examples necessary for such work.

The cotton spinning and weaving departments have been instituted in order to provide sound theoretical and practical instruction for those who are engaged in these important local industries. The courses include the spinning of yarns and the design and manufacture of all kinds of cotton fabrics. The classes are therefore of great service to those who are engaged not only in the manufacture, but also in the distribution, of such goods. The equipment of the departments includes

a complete range of spinning and weaving plant, and the lectures are fully illustrated by means of lantern slides, models, etc.

The object of the art department is (1) to give a thoroughly practical knowledge of designing, drawing, painting, and modeling, especially in their various applications to trades and industries; (2) to give facilities to those persons who desire to adopt art as a profession or to make it part of their general education.

The school year opens in September. The sessions of the evening classes close in May and the day classes in July. All classes are open to persons of either sex. Tuition fees are payable in advance.

The institute is under the general management of a technical instruction committee, consisting of 5 aldermen and 15 councilors of the Salford County Borough Council, together with the mayor and an ex-mayor. There are 2 representatives—the principal and one of the professors—from the council of Owens College, Manchester, and 2 representatives from the Salford school board, in accordance with agreements made between these educational bodies and the committee. The committee have, in addition, appointed 12 members, all either large manufacturers or representatives of the various industries carried on in the borough, and appointed on account of their special technical knowledge to assist in organizing the work of the institute on truly technical lines, so as to insure that the instruction and the equipment provided will be complete in every detail.

The staff of instructors consists of the principal, 10 chief lecturers, and about 35 assistant lecturers and demonstrators, all of whom have had practical training and are specialists in their own departments.

During the session of 1898–99 there were 1,431 individual students in attendance, making 2,823 class entries. Of the latter number, there were 2,640 entries in the evening classes. The entries in the trade, technical, and art classes were as follows: Day technical classes, 31; day art classes, 48. Evening classes—pattern making, 13; engineering workshop, 20; building construction, 120; carpentry and joinery, 111; plumbing, 95; sanitary science, 14; painting and decorating, 21; electric wiring and fitting, 98; cotton dyeing, bleaching, and printing, 62; cotton weaving, 65; spinning, 15; art classes, 128; wood carving, 15.

It is stated that many benefits of a general character have accrued to the industries of the locality as a result of the establishment of the institute, and that it has increased the intelligence and efficiency of the working classes generally in the community. The effect upon those who have been under instruction has been beneficial in every instance. Many young men who have graduated from the institute are now occupying responsible and lucrative positions in England and elsewhere. Many of the local manufacturers take a lively interest in the work of the institute, and some of them pay the tuition fee of apprentices. The success of the institute is said to have led to the improvement of

shop training in the locality. The institute does not profess to teach trades to the extent of turning out finished mechanics, hence the graduates are required to undergo the usual period of apprenticeship before engaging as journeymen. The officials state that the institute schools have proved highly satisfactory, and have fully attained the end for which they were established.

SALFORD IRON WORKS SCIENCE AND TECHNICAL SCHOOL, SALFORD.

This school was established in 1873 by the proprietors of the Salford Iron Works for the purpose of enabling the apprentices in the works to study the sciences allied to their trade. The firm requires all apprentices to attend the classes or, in certain cases, classes at other approved institutes, as a condition of their employment in the works, so that each handicraft may be acquired at the same time as the technical knowledge necessary to it.

The classes meet four evenings each week during the session. The course of instruction covers three years. The studies are arranged with a view to giving the students a thorough training in the elementary subjects. The studies of the first year include machine drawing and practical plane geometry. In the second year machine construction and drawing, plane and solid geometry, and applied mechanics are taken up. The work of the third year includes a review of the second year's course, with the addition of new examples and experiments. Students who have made satisfactory progress proceed with the consideration of more difficult problems in geometry and a more thorough study of miscellaneous details. The school is managed by the company. There are 5 instructors. More than 800 pupils have received training in the school since it was established. It is stated that the school has been very profitable to the company in that it has helped to train up a better and more intelligent class of mechanics, whose services have been employed with advantage by the company, as well as by other industrial establishments.

SHEFFIELD TECHNICAL SCHOOL, SHEFFIELD.

The Sheffield Technical School, which is a branch of the University College of Sheffield, was established in 1883. The City and Guilds of London Institute had granted an annual sum of £300 ($1,460) for five years to the Firth College to found a professorship of mechanical engineering, with the proviso that a sufficient sum for appliances and maintenance should be raised from local sources. To give effect to the conditions of the grant, and to assure the establishment of a more comprehensive system of technical instruction, a public meeting was held on December 13, 1883, "for the purpose of carrying out in connection with Firth College a proposed technical department, having

special reference to the trade of the district." An executive committee was appointed to carry out the work, and so satisfactory was the response to the demand for subscriptions and donations toward the school that a commencement was made in October, 1884, with lectures given in the Firth College. The scheme was, however, not in full operation until February, 1886, when the work was transferred to new buildings especially erected for the use of the school at a cost of £13,000 ($63,265).

After the passing of the technical instruction act in 1889 application was made to the town council of Sheffield to put the act in force, and to undertake the support of the technical classes. This application was granted, and the council of Firth College agreed, as long as the school was supported from local taxation, to transfer their governing powers to a new committee composed of representatives of the town council, Firth College, and the subscribers to the school. Between this date and that of the incorporation of the new college the site and buildings of the technical school were greatly extended and improved, over £12,000 ($58,398)—paid out of grants by the city corporation—having been spent in providing large additions to the metallurgical and engineering departments. In 1897 steps were taken to amalgamate the Firth College, the Sheffield Medical School, and the Sheffield Technical School, and a new charter was taken out under the name of the University College.

The technological work is divided into two sections, namely, a technical department and a technical school. Day students over the age of 17 and such day students between the ages of 16 and 17 as have passed an entrance examination are admitted to the technical department, the work of which comprises engineering, metallurgy, and coal mining. The work of the technical school comprises the instruction given in the evening classes and, to such day students as do not belong to the technical department, in subjects preparatory or supplemental to the work of that department. Students may join any one of the classes without entering for the whole course; they may also enter for instruction or research in any special branch of engineering or metallurgy.

The engineering courses are designed to meet the requirements of youths intending to become mechanical, electrical, or mining engineers, architects, or engage in industries where a knowledge of mechanical principles is of importance. The full course extends over three years and includes attendance at lectures and classes, experimental work in the laboratories, and practical work in the workshops and drawing office. All students in the day classes take the same general course for the first two years, after which they specialize during the third year in either mechanical, electrical, or civil engineering.

The workshop courses, though not intended to supersede the training of the engineering factory, provide students with the means of acquiring more or less manual skill in the use of tools and the performance of the various operations as carried out in engineers' shops.

The woodworking department contains benches to accommodate 36 students working at one time, and is equipped with all necessary tools and wood-turning lathes. There is also a smith's shop, which contains appliances for giving instruction in forging, welding, hardening, tempering, annealing, etc. In addition to the usual courses in mathematics, mechanics, and physics, lectures are given in mechanical engineering and machine design.

The work of the mining department is arranged in two courses, namely, advanced and certificate. The advanced course is for students who, while serving their articles or just before doing so, are able to devote the whole of the first year and two days a week in the two subsequent years to work in the school. The certificate course is arranged for those who are already engaged in colliery work and who can attend the lectures and classes one afternoon each week for two years. The studies outlined in this department include coal mining, experimental mechanics, chemistry, steam, mine surveying, electricity as applied to coal mining, metalliferous mining, and a course for local teachers in coal mining.

The distinctive feature of the school is the metallurgical department. This department has been equipped with a view to meeting thoroughly the requirements of local industries, and is now considered the most complete of its kind for teaching the practical manufacture, the chemical constitution, and the physical properties of steel. The course in metallurgy is as follows:

PRACTICAL METALLURGY—IRON AND STEEL.

First year: Elementary iron and steel analysis; determination of carbon by color; estimation of silicon, phosphorus, manganese, iron, and sulphur; mixing, melting, casting, chemically and mechanically testing, forging, hardening, and tempering the various qualities of crucible cast steel, annealed and unannealed.

Second year: Advanced iron and steel analysis; determination of carbon by combustion; estimation of tungsten, chromium, copper, and aluminum; mixing, melting, casting, and chemically and mechanically testing the various kinds of pig irons cast in chills, in sand, annealed and unannealed; manufacture of cast iron, malleable iron, and steel castings; case hardening, manufacture and testing of the various qualities of open-hearth steel; analysis and mechanical testing of the various qualities of Bessemer steel.

Third year: Advanced iron and steel analysis; determination of arsenic, nickel, and titanium; microscopical examination of steel and iron; analysis of fuel; analysis of furnace and waste gases; practical calorimetry; analysis of iron ores; dry assay for iron; analysis of slags and refractory materials; pot making; preparation of metallic tungsten, ferro-manganese, ferro-chrome; technical analysis of boiler water, practical pyrometry; determination and platting of the recalescence curves of steel.

METALLURGY OTHER THAN IRON AND STEEL.

Section I: Assay of gold, silver, copper, and lead ores by wet and dry methods; copper and lead smelting; gold, silver, and copper parting; analysis of fuel and practical calorimetry.

Section II: Analysis of brass, gun metal, German silver, britannia metal, type metal, fusible metal, and white metal; mixing, melting, casting, and chemically and mechanically testing the alloys; analysis of refractory materials.

PRACTICAL FUEL COURSE.

Complete analysis of coal, coke, etc.; calorimetric determination of their evaporating power; determination of the caking or noncaking properties of the various classes of coal; determination of the quantity and composition of the gas yielded by various coals; eudiometric analysis of gaseous fuel; testing of fire clays.

In addition to the practical course there are also lecture courses on iron and steel manufacture, fuel and refractory materials, and on general metallurgy.

Workshops: The ironwork course consists of graduated exercises at the vise, with practice in the use of the various tools and appliances. The machine tool shop course is intended for the more advanced students, and consists of (1) the study of the design and construction of the various standard types of machines; (2) a course of practical exercises, to enable the student to acquire a working knowledge of the use and capabilities of the machines. In the woodwork shop the courses of instruction include a general course on the use of woodworking tools, including the elements of engine pattern making.

Engineering drawing: In the drawing office students are taught to make working drawings from dimensioned sketches, as well as to make hand sketches from actual examples of machine details. More advanced students prepare drawings, both general and detailed, from actual measurement of engines and machines and from original designs.

In the design class a course of 30 lectures is given on the design of engine and machine details.

The work is principally carried on in a building equipped with a 25-hundredweight open-hearth steel furnace, complete with gas producer, hydraulic cranes, forced-draft appliances, and falling-weight test; a 50-ton testing machine, complete with tensile torsion, crushing, and transverse gear; a crucible-steel house, melting holes, pothouse, and pot-making tools. There is a flame and ore annealing furnace for the production of malleable iron castings and the annealing of steel castings and an iron cupola, drying stove, and all appliances necessary for the production of green and dry sand castings. The laboratory is fitted with modern apparatus for metallurgical analysis, more especially for the rapid and accurate chemical examination of iron and steel, fuel, and refractory materials; also a complete pyrometric installation and specially designed appliances for the micrographic analysis of metals. General metallurgy is also covered in a separate course dealing with metals (other than iron and steel) used in the arts.

The courses of instruction in the evening classes are of a more varied character than those of the day classes and, among others, include electroplating, carpentry and joinery, plumbing, building construction, etc.

The school year commences in September. The sessions of the evening classes close the latter part of April, and those of the day classes extend to the latter part of June.

The school is managed by a technical committee, a majority of which consists of representatives of the council of the city of Sheffield.

There are 12 professors and lecturers. The instructors in shopwork have had practical training. During the session of 1899–1900, there were 169 students in the day classes and 907 in the evening classes. The attendance in the principal evening classes was as follows: Mathematics, 110; magnetism and electricity, 108; electrical engineering, 192; machine construction and drawing, 169; applied mechanics, 82; steam engine, 121; engineering workshops, 34; lectures on iron and steel, 70; lectures on fuel, 31; electroplating, 17; building construction, 132; plumbers' classes (lectures and geometry), 42; carpentry and joinery, 84; photography, 15; telegraphy and telephony, 20.

The revenue of the school is derived principally from grants from the city of Sheffield, the county councils, the Drapers' Company of London, and from tuition fees. The cost of maintenance for the year ending June 30, 1900, was £9,765 ($47,521).

The benefits which have followed the establishment of the school are said to be of a general character. The school has increased the intelligence and efficiency of the working classes generally and has contributed a great deal toward promoting industrial, educational, and social development in the community. For a time the school had some trouble with local labor unions because of the fact that the plumbing classes were opened to architects and employees who had not served an apprenticeship. There was also some trouble during the earlier years with the steel workers' unions, which arose in connection with the metallurgical classes. These controversies were readily adjusted, and now, it is said, the school has no stronger friends than the trade unions, three members of which are on the council committee. It is stated that higher wages, steadier employment, and more rapid promotion have accrued to those who have attended the school.

All graduates are required to serve a full period of apprenticeship before engaging in regular work. In the opinion of the officials the success of the school has led to improved shop training in the vicinity.

The school has proved satisfactory in every respect and has attained the end for which it was established.

MINING AND TECHNICAL SCHOOL, WIGAN.

This school was organized in 1857 and opened to the public in August, 1858. Classes in mining, geology, chemistry, and mechanics were formed, and instruction suited to the needs of the working people in

the district was begun. The work continued on these lines for a number of years with a considerable degree of success. In 1893 the Wigan technical school committee, the county borough council of Wigan, and the Lancashire County Council undertook the joint management of the institution. The school committee gave the use of the school property, the interest of an endowment fund of £5,000 ($24,333), and continued their annual subscriptions; the county borough council gave the whole of the amount received under the local taxation (customs and excise) act of 1890, and the Lancashire County Council gave a yearly amount of £500 ($2,433) and threw open their scholarships to competition by residents of the borough of Wigan on equal terms with residents of the county. This joint arrangement enabled the work of the school to be greatly enlarged and made it necessary that larger and better accommodations should be provided. In 1897 the managing director of the Wigan Coal and Iron Company, a concern employing some 10,000 people, who had always taken an active interest in the work of the school, took the initiative in raising a sum of £40,000 ($194,660) with which to build and equip a mining and technical college. This proposition met with popular favor, and ample funds were obtained, and the work of construction was commenced at once with the expectation that by 1902 the work of the school, which heretofore has been conducted in buildings some distance apart, would be transferred to a handsome, commodious, and thoroughly equipped building.

The chief subject of instruction has always been that of mining, and the large classes have comprised a substantial proportion of working miners. Class lectures have been given in mining on several evenings in each week according to the syllabus of the science and art department. Since the passing of the coal mines regulation act in 1872, which made it necessary for intending colliery managers to obtain certificates by examination conducted by the home office, special courses of instruction have been given on Saturdays, and have been well attended by those aspiring to the management of mines. During each session visits, on the invitation of colliery owners and managers, are made to collieries in the district, and every facility is afforded for obtaining personal information on the best mining practice in every department.

In addition to the mining department there is a large range of subjects in other departments. The courses in the science department include theoretical and applied mechanics, building construction and drawing, chemistry, magnetism and electricity, machine construction and drawing, mathematics, geometry, steam, and engineering. The technical courses embrace carpentry and joinery, cotton spinning and weaving, and iron and steel manufacture. In the art school instruction is given in free-hand, model, and perspective drawing, light and shade work, modeling, painting, principles of ornament, and design. There

are also commercial and domestic courses and a manual course in woodwork and wood carving.

The regular school year opens in September and closes the latter part of June. There are 24 instructors. During the session of 1898–99 there were 1,705 individual students, making 2,922 class enrollments in 38 departments and subjects.

Hitherto the operations of the school have been confined almost entirely to evening sessions, and as the instruction provided is chiefly for the benefit of the masses of the people, the executive committee strongly favor the continuance of this plan, as it enables the students to follow practical work in the mine, mill, and steel works during the day. When the new buildings are occupied, it is proposed to arrange a plan for imparting preliminary education on art, science, and technical subjects during the day to the best scholars of the elementary public schools in the town and district.

The benefits accruing as a result of the establishment of the school are of a general character. Many of the early students are now holding distinguished positions in the industrial works of the district.

SCOTLAND.

HERIOT-WATT COLLEGE, EDINBURGH.

In October, 1821, this school was opened under the name of "The School of Arts." Its announced purpose was "for the better education of the mechanics of Edinburgh in such branches of physical science as are of practical application in their several trades." With this general object in view the two leading classes then established were those in chemistry and mechanical or natural philosophy. These have continued to the present to be fundamental subjects of education in the school. The first session was attended with great success, the number of students having been 452; and at its close, in accordance with the wish of a number of students, a class in mechanical drawing was opened during the summer session. During the first session the students organized among themselves a class in higher arithmetic and geometry, and this led to the foundation of a regular class in mathematics. For many years no other classes were added, but in later years the range of the education offered has been enlarged until its present scope has been reached. Women were first admitted in 1869. The premises first occupied were of a very humble character.

In 1851 the Adam Square building was purchased at a cost of £2,500 ($12,166), and the institution took the title of The Watt Institution and School of Arts. In 1871 this building was pulled down. Arrangements were made to transfer the school to Chambers street, and it occupied its new buildings in the winter of 1873–74. In 1885 the school was consolidated with George Herriot's hospital and in 1886 entered upon its present plan of operation under its present name.

This institution is said to have been the first in Great Britain which was founded for the express purpose of giving education in the principles of science to the industrial classes. As time passed it entered upon a much larger field of education than was contemplated by its founders, but the management has never lost sight of the leading idea of making its work of real practical interest.

The fees charged for the various courses vary according to the course taken and the number of hours daily devoted to classes. The fees of artisan students, or of others who desire to attend the day classes and require aid to do so, may be remitted in whole or in part; but applicants requesting this remission are required to furnish satisfactory evidence of their fitness to benefit by the instruction given at the college. Students not engaged in the trade to which their studies apply are charged, for some of the courses, a greater fee than is charged apprentices or workmen.

The work of the college is divided into day classes and evening classes, and the courses of study cover a wide range of subjects outside of those properly coming within the scope of this inquiry. The day school offers instruction in mathematics, physics, electrical and mechanical engineering, mechanics, chemistry, commerce, modern languages, and to special classes in agricultural subjects. The evening school provides courses in fine art, chemistry, mining, geology, botany, zoology, physiology and hygiene, veterinary science and literary and commercial courses, as well as those subjects mentioned under the day school. Instruction of a technical character is given in a number of trades and occupations, and brief outlines of these courses follow:

Metal working: These classes offer instruction, both theoretical and practical, in fitting, turning, machining, and smithing. The practical side of the course is given special emphasis, and students are trained in the use of the various tools and machines, and required to perform the operations usual in the factory or workshop.

Carpentry and joinery: This class is intended for persons actually engaged in the trade, and with it must be taken building construction and geometry, unless the student is already proficient therein. The course embraces such subjects as timber, tools, and labor-saving machinery, drawing-in rods for frames, working drawings showing in detail the proper construction of doors, windows, stairs, trusses, roofs, newels, etc.; mortises, tenons, bevels, hip rafters, etc., and advanced instruction in the more complicated operations in building. Ample practical work is given throughout the course, and each student is required to design and execute an original piece of work to submit to the science and art department before he can take that examination.

Masonry and brick work: The course includes bond in brick work, hollow walls, bonding stones, ashlar, rubblework; description, suitability, and preferences of various stones; nature of limes, cements, and sands; construction of foundations, sewers, stone stairs, arches, and cornices, and working detail drawings of various constructive and ornamental features of masonry and brickwork.

Plumbing: This course has been arranged with a view of encouraging apprentices to take it in its entirety. Those portions of arithmetic, drawing, and physics which are necessary to a proper understanding of the work are provided in the first year's

studies. This year also includes instruction in lead laying, pipe bending, and soldering. The work of the second year embraces laws of heat as affecting materials, liquids, and gases, properties of materials, tools employed, solder and soldering, blowpipe work, brazing, roofing, traps, drains, ventilation, water supply, cisterns, closets, baths, etc. Each student receives two hours' practical instruction each week. These practical exercises include setting out, fixing, and laying platforms, domes, turrets, and dormers; setting up, mitering, turning, etc.; making and fitting apparatus; bending, supporting, and fixing pipes, and lining sinks and cisterns. There is a course in sanitary science arranged to supplement the course in plumbing.

Cabinet making: This class takes up all kinds of furniture, of which full size detail drawings are made. The various styles, such as Adams, Sheraton, and French, are dealt with. The work of the class includes exercises in drawing cabinet and chair work to scale; construction and setting out rods; information as to woods, veneering, and other matters connected with the trade.

Typography: Among the subjects treated of in this course are type ratios in relation to sizes of books and prices of composition; the linotype, or other type composing and distributing machines; the production of line and half-tone blocks; printing in colors; the principles of machine construction for letter-press printing; making estimates, and the general management of a printing office. The necessary practical instruction required in the course is not given in the college, but under the Edinburgh branch of the British Typographia, and students in the college are limited to those who have attended practical classes. Such instruction in arithmetic, theoretical and applied mechanics, English, Latin, Greek, French, and German as is useful to printers is provided for those who desire to avail themselves of it.

Lithography: The class work of this course is arranged with a special view of providing apprentices such elementary instruction concerning materials and processes as will help them to understand what they see and do in the workshop. The subjects included are methods of patching, transferring and printing, preparing work drawn on stone, mixing of colors and proving chromo work, and various devices employed and details to be attended to are discussed. Opportunities for practical work are afforded to the greatest possible extent.

Watch and clock making: The subjects of technical study in this course are chosen and arranged with a view to qualifying students for the City and Guilds examinations, and embrace time, characteristic properties of metals employed, motors, calculation of trains, friction, tools, escapements, pendulum, balance and balance spring, and drawing.

There is a class in wiring and electrical fittings which is arranged for wiremen and other workmen in electrical trades. Instruction is also given in electrical instrument making and in other subjects connected with general electrical work. Systematic instruction is offered to apprentices in house painting, including lettering, graining, mixing material, cutting stencil, etc. There are also lecture courses in carriage building, photography, gas manufacture, and ornament and design.

The college is under the control of a board of governors consisting of 21 members.

During the year 1899–1900 there were enrolled 157 day students and 3,886 evening students. Of the total number 639 were females. Some idea of the class of male students attending the college may be had from noting the trades from which they are drawn. There were in the evening school 411 students from building trades; 489 engineers,

metal workers, etc.; 101 from printing trades; 119 painters; 126 plumbers, gas fitters, etc.; more than 900 clerks, salesmen, bookkeepers, etc.

The industries of the city have undoubtedly been benefited by the college. Many employees insist that boys shall take the day course in the college before beginning their apprenticeship, and offer to take shorter terms of apprenticeship in case they do. While apprenticeship is usually required, in many instances it is merely nominal.

Labor unions have always been friendly. They recognize the value of the training given, as they observe the rapid rise of those who have received it.

GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE, GLASGOW.

The main objects of this college are to afford a suitable education to those who wish to qualify themselves for following an industrial profession or trade, and to train teachers for technical schools.

The college was founded in 1886, in accordance with a scheme framed by the commissioners appointed under the provisions of the educational endowments (Scotland) act, 1882, whereby Anderson's College, the Young chair of technical chemistry in connection with Anderson's College, the College of Science and Arts, Allan Glen's Institution, and the Atkinson Institution were placed under the management of one governing body. Considering Anderson's University, incorporated in 1796, as the beginning of the present college, it is the oldest college of its kind in Europe. The chemical laboratory, opened in 1830, was the first public laboratory in Great Britain.

Complete courses are provided in mathematics, natural philosophy, chemistry, drawing, engineering, and other subjects, and the application of these subjects to the industries and arts. In the day classes instruction is given in civil engineering, mechanical engineering, naval architecture, electrical engineering, architecture, chemical engineering, metallurgy, mining engineering, mathematics and physics, chemistry; in the evening classes are taught mathematics and physics, chemistry, natural science, chemical industries, mechanical engineering, naval architecture, metallurgy, electrical engineering, coal mining, architecture, and building construction.

Students 16 years of age or over are admitted to any of the college classes in the day school on satisfying the professors whose classes they attend that they are prepared to profit by the instruction provided. Students under 16 years of age and those who desire to qualify for a diploma must pass a preliminary examination in English, mathematics, and free-hand drawing. Students desiring admission to the evening classes are expected to have gone through a course equivalent to that of a board school, and to possess such knowledge as will enable

them to profit by the work of the classes. The fees vary according to the course taken, but are generally lower in evening classes than in day classes. A number of bursaries, scholarships, and medals are annually awarded. These prizes vary in value from £2 to £125 ($9.73 to $608) per year.

The ordinary courses of study in day classes extend over three years, but arrangements are made for advanced students to continue their studies in any of the laboratories. The day classes are complete in themselves as far as possible, but students are strongly advised to attend such evening courses of lectures of a practical nature as have a special bearing on the department they may have selected. Students are at liberty, however, to extend their work beyond three years, or to vary its order, if they find it necessary or convenient to do so.

Courses of study in evening classes are designed to meet the wants of students engaged in the chief local industries. Each course usually occupies four winter sessions, but may cover a longer period if a student so prefers.

The full day courses are civil, mechanical, electrical, chemical, or mining engineering, naval architecture, architecture, metallurgy, mathematics and physics, and chemistry.

The day classes also offer short lecture courses in a number of subjects of interest and value to those who have not the time to devote to a full course.

The evening classes are arranged more particularly with a view of accommodating those engaged in industrial occupations. Some of the more important courses are here outlined:

Plumbing: The instruction is divided into two lecture courses, with accompanying shop work. The first course deals with the properties and qualities of leads, zinc, tin, cements, etc.; solders (their composition and use), fluxes, soldering bits, blowpipe work, brazing, and plumber's tools; geometry as applied to plumbing, cutting out sheet lead, setting out work and making working drawings; workshop arithmetic; roofing, rain drainage, and other external plumbers' work; varieties of traps, soil pipes, drains, their sizes, materials, and construction; water supply for houses, such as the construction of cisterns and their management and care, water-closets, baths, lavatories, sinks, etc.

The second course enters into a more detailed treatment of the above subjects and takes up in addition the action of air, waters, acids, gases, etc., upon lead, zinc, and tin; the manufacture of metals into the various forms in which they are used in plumbing; casting lead tubes and coating them internally; sanitation, hydrostatics, and hydrodynamics; principles of hot-water circulation and hot-water heating; and the various systems for the disposal of sewage.

The practical shopwork includes traps, bends, and pipes; solder jointing by iron, copper, bolt, and blowpipe; making and fitting up bath waste connections, and lining cisterns and sinks; roof work, platforms, gutters, cesspools; various forms of solder jointing; pipe bending by various methods, and other practical plumbing operations. No one is admitted to the practical class who is not attending the lectures or who has not previously attended them.

Sheet-metal work: These classes are conducted in association with a committee appointed by the Scottish Tin Plate and Sheet-Metal Workers' Society, and the

instruction is of a thoroughly practical character. The subjects embraced are drawing, geometry in its applications to sheet-metal work, mensuration rules, patterns of various kinds, the manufacture of all kinds of sheet metals, tinning and galvanizing processes, brazing and soldering; general principles of hollowing, planishing, stamping, and annealing sheet metals; joining sheet metals by brazed, soldered, riveted, and grooved joints; baths, hoods, domes, spout patterns, pipe bends, physical and chemical properties of metals and fuels, etc. Ample practical work is provided in the well-equipped workshop. These classes have been in operation only one year (1901), yet this course is said to have better attendance than any other of its kind in Great Britain.

There is a very comprehensive and thorough course in architecture and building construction, which seems to be designed for architects rather than mechanics. Every detail of building construction is thoroughly taught.

The department of industrial arts offers instruction in house and church decoration, sign writing, imitation of woods and marbles, glass gilding, etc.; ornamental work, lithographic printing, furniture designing, and wood carving. Some of these courses include practical shopwork, notably lithographic printing and wood carving.

The institution is under the management of a board of governors.

During the year 1898–99 there were 3,786 students in attendance at the college, of whom 3,485 were in evening classes and 301 were in day classes. In the sheet-metal classes there were 141 theoretical students and 115 who took practical work. There were 174 in the theoretical and 97 in the practical plumbing classes. The classes in architectural building had 409 theoretical students and 147 who took special courses in some branch of the subject.

The college owns and occupies several buildings, but it has not room to accommodate all who desire to attend. A new building is now (1901) in prospect and a fund is being raised for that purpose.

The work of the college has increased the intelligence and efficiency of the working classes and has enabled them to have steadier employment, more rapid advancement, and better wages. Trade unions are very friendly to the institution, as is evidenced by the fact that plumbers and sheet-metal workers' associations have been instrumental in establishing classes for their trades. The general benefits accruing to the industries of the locality are suggested by the growing number of students, and by the fact that employers show a preference for former students.

Heretofore the theoretical side of education has been more emphasized in most of the college work, but when the prospective new building is completed more practical instruction will be given.

The income of the college from all sources for the year 1899 was somewhat in excess of £25,000 ($121,663). More than £20,000 ($97,330) of this amount came from endowments and public sources, only about £5,000 ($24,333) having come from fees from students.

IRELAND.

Technical instruction has not as yet made much progress in Ireland, except in a few of the larger cities.

The return of the department of science and art, "showing the extent to which, and the manner in which, local authorities in Ireland have applied, or are applying, funds to the purposes of technical education (including science, art, technical and manual instruction) during the year 1898–99," shows that twelve local authorities made grants under the technical instruction acts, and that one of these authorities is also applying part of the taxes levied under the public libraries acts to teach technical education.

The more important schools where technical instruction is given are located in Dublin, Belfast, Cork, Galway, Pembroke, and Limerick.

Most of the schools give instruction in the subjects of the science and art department, and in addition thereto technical instruction is also given in the following subjects: Flax spinning, linen and woolen weaving, plumbing, carpentry and joinery, pattern designing, mechanical and electrical engineering, dyeing and printing, tailoring, painting and decorating, metal-plate work, boot and shoe making, boat building, net making and mending, lace making, embroidery, millinery, dressmaking, knitting, cookery, laundry work, wood carving, etc. The amount expended toward the maintenance of technical classes for the session of 1898–99 was £4,523 ($22,011), and of this sum £3,617 ($17,602) was raised under the local rate of 1 penny in the pound.

ATTITUDE OF EMPLOYERS, GRADUATES OF TRADE AND TECHNICAL SCHOOLS, AND LABOR UNIONS TOWARD TRADE AND TECHNICAL EDUCATION.

The statements that follow present in a condensed and summarized form the opinions of employing proprietors of establishments in a number of leading industries, graduates of trade and technical schools, and officers and representative members of labor unions in regard to industrial education. The information was obtained from representative persons in various parts of the country through personal visits of agents of this Department. The statements made set forth the opinions of the persons responding to the inquiries of the Department, just as the statements of the preceding portions of this chapter in regard to the schools are largely the opinions of the school officials. The persons personally interested in the subject thus speak for themselves. In no case should these criticisms or opinions be considered as emanating from this Department.

ATTITUDE OF EMPLOYERS.

BOOT AND SHOE INDUSTRY.

Technical schools are proving to be of great advantage to this industry. They have raised the average value of the workman to his employer, and consequently students and graduates are more sought after and receive higher remuneration. It is said that further provision for special education in the trade would enlarge and improve the industry, and it is generally conceded that failure to make such provision will result in injury to the business.

It is admitted by some that the American shoe manufacturer can produce his goods at less cost than his English competitor and at the same time pay comparatively higher wages. This is accounted for by the fact that the American workman can do more work in a given time, while the factory is better organized and consequently can turn out a greater production with a given number of operatives. The cure for this difference in the productive capacity of the workmen of the two countries is thought to be technical training. One manufacturer says:

English workmen have persisted in applying old and worn-out principles to modern industry, while the Yankee workman endeavors to operate his machine for all it is worth, and the only limit to its productive capacity is the relative ability of the operatives. Industrial training must be provided to explain and illustrate the practical working of modern machinery to foremen and workmen generally. If technical education had been adopted twenty years ago, instead of being talked about, there would have been much greater improvement in production, * * * and the trade as a whole would have been in a much better position than it is to-day to compete in the mutual markets of the world.

The best workmen are those who have had shop training supplemented by technical school training. There are few apprentices in the trade, and all arrangements concerning apprenticeships are usually made to conform to union rules. There is never any interference, so long as the number of boys (not apprentices) is kept within the agreed limit. Only extraordinary boys will learn the trade thoroughly in the factory. Specialization of work makes it next to impossible to learn more than is found in the particular departments in which they are employed. There is no systematic instruction in the shop, and the learner follows the ordinary routine of daily work.

BUILDING TRADES.

The weight of testimony among builders, and especially among master plumbers, is to the effect that technical schools have increased the general intelligence of the workmen. Notwithstanding the fact that in some communities the facilities already provided are not fully utilized by the workmen, it is thought that further provision for technical instruction would be a benefit to the industry generally.

While shop training is absolutely essential to an acquaintance with practical routine work, yet it is difficult, and in most cases impossible, to learn a trade thoroughly in a shop. Apprentices are required to act rather as helpers to regular journeymen, and unless the apprentice is a "pusher" he serves thus until he is 21 years of age, and remains a laborer or unskilled hand. These conditions make school training necessary, and the general opinion is that the most perfect system of training consists in both school and shop instruction. In most cases the number of apprentices is limited to conform to the requirements of trade unions, and the latter do not put any obstacle in the way of the apprentice.

Some employers contend that school training should not shorten the regular period of apprenticeship, while others think that faithful attendance upon a good technical school should entitle the apprentice to a reduction of from one to three years from the regular term.

CARRIAGE BUILDING.

A director in one of the most prominent coach manufacturing companies in London says that technical training has stimulated the personal interest of the workmen in their trade; it has developed their intelligence and made them quick to perceive and ready to adopt new methods; their character has been improved; and they are therefore of more value to employers, and get better pay and more permanent employment. Additional facilities should be afforded for workmen to attend technical schools, and it is thought that it would be beneficial if attendance were made compulsory.

The best training is that of the shop and school combined. In the shop one's time should be devoted to rapid execution of work, and this does not permit instruction. There is no regular system of training in the shop, and there are few apprentices in the coach-building trade in London. School instruction should not shorten the time which a learner should serve in a shop. Manual ability can only be tested and proved by shop experience.

DYEING.

One man engaged in this business says that the industry can not be enlarged or improved by further provision for technical education, and another one says it can. It is agreed, however, that sound technical training is very valuable in connection with shop training. In ordinary practical work shop training alone is adequate, except in giving a knowledge of chemistry, and this must be acquired in some school. Shop training is given only in connection with the ordinary routine of the work. Trade instruction should not shorten the terms of apprenticeship, except in special cases. Labor unions do not interfere with apprenticeships in this industry.

FURNITURE AND CABINETMAKING.

The representative of an upholstering establishment says that trade schools relating to this industry are of too recent establishment to show much effect upon workmen. It is his opinion that technical training for foremen, workmen, and designers would be a great advantage to the business, and that unless better provision is made for such training in the immediate future the industry must suffer.

The ideal training is shop practice supplemented by technical instruction, but the school training should not shorten the term of apprenticeship. There has been no conflict with labor unions as to the number of apprentices, but the unions are sometimes extremely arbitrary as to the time when a boy shall be advanced to the stage of an "improver." The mechanical training in the shop is good, but unless a youth is acquisitive he gains little technical knowledge. There is little system in shop training in this industry.

HOUSE DECORATING.

This industry has been improved by technical schools, although in communities where the schools are of recent origin the improvement is not so marked. The schools develop intelligence in their pupils, and consequently give to the trade workmen who are of more value to employers. Their superiority is appreciated and they are soon able to command full wages. Further provision for technical instruction would benefit the industry in general, and it would be of special advantage to the artistic side of the trade. Education begets and cultivates higher ideals, and if it is not provided there is danger, some believe, of the industry going backward. Others feel that there will always be men who will find their way to the front, whether there are schools or not.

Lack of systematic training in the shops makes it essential for the apprentice to attend a technical school. Shop training is of most importance, and in exceptional cases is sufficient, but the majority of workmen would be benefited by a supplementary technical course in a good school. In most branches of this business the number of apprentices is limited by trade unions, but the limitation varies in different localities. Apprentices are usually bound until they reach the age of 21 years, the apprentice usually beginning at the age of 15, thus making the term six years. There is a feeling that labor unions are too exacting with reference to apprentices. As has been intimated, the trades do not afford adequate instruction for learners. Competition compels employers to consider first their own interests, and this frequently conflicts with the interests of the apprentice.

Boys who have spent a year in a technical school should have that much time deducted from the term of apprenticeship, but no amount of school training can entirely take the place of a practical training under the highly varying conditions to be met in shop work.

IRON AND STEEL.

The special education provided for some of the trades in this industry has produced a marked improvement in style of products and methods of work, and it has increased the wage-earning power of those who have taken advantage of it. Further provision for trade and technical instruction would certainly improve the industry, and if such provision is not made it is thought that it will suffer from the competition of those countries that are more advanced in their methods of technical and scientific instruction.

Some trades provide the apprentice with adequate instruction, but on account of the lack of system most of them do not, the instruction being usually dependent upon workmen under whom the apprentice serves. Opinion among employers is about equally divided as to whether school instruction shortens the term of apprenticeship or not. All agree that the ideal trade training is a combination of school instruction and shop practice.

METAL TRADES.

Technical schools have been generally beneficial to workingmen in the metal trades. The apprentice who has been to a school comes to his work with a fair knowledge of the use of tools and with a greater intelligence than his fellows. The school has enlarged his ability to understand and take hold of his work, it has improved him in character, elevated him as a man, and therefore made him more useful to his employer, besides enabling him to command better wages. Occasionally there is found an employer who has not been so favorably impressed with the work done by the schools, but such are rare.

Among a large proportion of employers there is a conviction that this industry could be improved by further provision for technical education, and that the business will suffer if such provision is not made. Others say they would like to see further results from the schools already established before expressing an opinion as to the desirability of establishing more.

It is universally agreed that the shop and school combined afford the ideal training. Shop training alone leaves the workman entirely dependent upon his foreman. He may be a good workman, capable of rendering satisfactory service in that line where he has had ample experience, but take him away from this and he will fail, while a technical man would have no difficulty in succeeding. Shop training alone does not sufficiently develop the workman's mental power, and under modern shop methods thorough training is impossible.

In some localities labor unions limit the number of apprentices to one for every four journeymen. The usual term of apprenticeship is five years—from 16 to 21 years of age—and this is not considered too long. A few shops have an arranged system of training for their

apprentices, but in most places the apprentice goes through the ordinary routine of the shop in the manner that is most valuable to the employer. For the ordinary workman this is thought to be sufficient, but for those who aspire to higher positions as foremen or superintendents it is inadequate. It is not considered wise to shorten the term of apprenticeship because of any technical training an apprentice may have had. It is best for him to serve the full term, for by so doing he will gain enough to compensate him for the time spent.

MODELING AND SCULPTURE.

Technical training, it is said, makes a workman more intelligent, careful, and skillful, thus securing for the trained workman a better remuneration, save in cases where trade unions require that all men shall be paid the same wages regardless of their ability. Further provision for technical and industrial-art education would enlarge and improve this industry, and it will suffer unless such provision is made.

Both technical instruction and shop training are necessary to make a good workman. The value of shop training depends largely upon the individual. He may get his trade in a shop, but the artistic side and the technique of the trade must be learned at school.

PRINTING AND PUBLISHING.

Some employers in this industry say that technical training for printers has not had time to show results, but they are hopeful of much good from this source in the future. Others, who seem to have had more extended observation and experience, say that technical schools have been a benefit to the industry. They turn out better equipped workmen, and it is obvious that the more an apprentice knows of the nature of his trade the higher wages he can command. While the schools now in existence are doing much for the betterment of the industry, the establishment of more schools and better facilities in those already established would bring still greater benefits, and it is thought that failure to make such further provision will undoubtedly cause the industry to suffer. This is especially true in color work. In some localities there is a lack of interest on the part of printers to avail themselves of the facilities now offered by the schools.

Labor unions generally limit the number of apprentices in such trades as compositors, pressmen, stereotypers, and machine tenders, and where the unions do not fix a limit custom does. The term of apprenticeship fixed by the unions is seven years. This is not generally regarded as too long, but one man says it is absurdly so, and thinks for technically trained apprentices the time should be reduced to four or five years. It is affirmed that shop training alone does not make all-round good workmen. In some instances this is due to the

apprentice failing to realize the importance of becoming thoroughly efficient; while in other cases it is because the shop does not afford opportunities to learn anything pertaining to the trade outside of the particular department in which the apprentice happens to be placed. The training in the shop is usually not systematic. The departmental division of work does not permit an apprentice to pass through all that the printer should know, and it thus becomes necessary for him to attend a school if he expects to become thoroughly skilled in his trade.

SCIENTIFIC INSTRUMENTS.

One of the best-known firms engaged in this business in England is so impressed with the value of technical education that it has a reading room in its factory and supplies technical books and periodicals for its employees, and encourages them to study at the various evening technical schools of the town by paying the tuition fees in all approved cases. The men in this establishment are all shop-trained, but many of them have also attended evening classes in technical schools. While these classes have been instrumental in promoting a more intelligent interest in the firm's business, it is thought that they would be much more useful if they dealt with matters more closely related to the daily duties of the workmen. Many of the men study drawing, which is valuable to any workman; but it is more important for them to know the properties of the materials they use and the scientific principles which underlie the physical changes they undergo. This kind of education explains to the intelligent workman the secrets that are just beneath the surface of his daily work.

This firm has always had the most pleasant relations with trade unions. There is a regular system of apprentice training, but it is not deemed sufficient to make high-grade workmen. Apprentices are paid wages from the start, which are increased each year during the term of five years. As schools are at present conducted it is not thought that any shortening of the apprenticeship term should be made on account of the school training.

TANNING AND CURRYING.

The effect of trade education is scarcely noticeable as yet in this industry, but it is thought that it can be both enlarged and improved by a wise and substantial provision of trade instruction. Without such provision the industry may suffer, both in itself and in its relation to competing countries where technical instruction is more largely provided for.

A combination of school and shop training is certainly the preferable method of learning a trade. The old apprentice system has largely died out. Specializing enables a boy to learn only in a few

departments, and no apprentice learns the whole trade. School training should not shorten the term of apprenticeship.

TEXTILE INDUSTRIES.

Generally good results have come to the textile industries through technical education, and the intelligence and efficiency of the workmen have been increased. This is specially noticeable among designers and pattern makers. They show better taste in color arrangement, more variety in design, and, as a rule, do better work. Overseers and weavers have gained a more intelligent grasp of their work. These accomplishments make them more valuable to their employers, and consequently they command better wages. There has been general improvement in British goods, both in design and quality, and a general tendency toward higher wages, but it is difficult to say how far these conditions are due to the influence of technical schools.

Manufacturers generally feel that this industry can be profitably enlarged and improved by a further provision for technical education, though occasionally one is found who thinks otherwise. Those who advocate more schools feel that they are necessary to maintain the present advanced position occupied by the British textile trade and to prevent comparative retrogression. One says that without such further provision "Continental and Yankee competition will run away with the trade." Another says that the "whole textile industry in the United Kingdom suffers now from a lack of such provision." Still another thinks that the benefits to be expected from more schools are rather indirect, and will come as a result of a rise in general intelligence.

The ideal training is agreed to be a combination of the shop and school, and this training is generally considered most valuable if taken concurrently. It is felt by some that there is a disposition to overestimate the advantages of technical education. It is not believed that a man could become an expert designer, for instance, with only school experience and outside private practice. Such a man could produce intricate and complex designs, but it is doubted whether he could introduce cloths of merchantable styles without having experience in a designing room.

One of the most substantial friends of technical education in Great Britain and a man of long and broad experience says: "The youth who has studied drawing, together with the science applicable to his work, other things being equal, has invariably taken the higher position. His technical training has qualified him for promotion or enabled him to step out of his particular track and enter another which gave him more scope for his acquirements. * * * The textile industry might be enlarged and improved by artistic and scientific training on the part of all those concerned with the designing, dyeing, and finishing of the cloth."

Training in the shops and factories is generally unsystematic and inadequate. A learner acquires a fair knowledge of the work done in his department, but outside of that he gains but little. Shop training is conducted with a view to business advantage rather than to training apprentices. In some instances apprenticeship is made unduly long and difficult by labor unions, while in many others such is not the case. Certain trade secrets are jealously guarded by the unions, and are reluctantly imparted to apprentices. There is much division of sentiment among employers as to whether technical training should shorten the term of apprenticeship. Some are emphatic in declaring that it should, while others advocate the old apprentice term of six or seven years.

WATCHMAKING.

Technical schools have resulted in good for this business. There is need, however, for more schools, and it is thought that the industry will suffer if they are not provided. Boys who go into the shops to learn this trade are put under selected men, who are paid to instruct them, but this shop work should be supplemented by technical training. One firm places such a high estimate upon the value of technical training that it has for some years given time to apprentices during working hours to attend afternoon classes in a technical school two days in the week, and it also pays their school fees. They have experienced good results from this generous course.

ATTITUDE OF GRADUATES OF TRADE AND TECHNICAL SCHOOLS.

CARPENTERS AND JOINERS.

The reason given by the graduates in this trade for taking a course of instruction in a technical school was that they wished to learn the theory of construction and to become more proficient in the practical side of the trade. They had served full terms of apprenticeship before attending school, but upon being graduated they obtained better positions and were able to command higher wages. Their school training has been a benefit to them, and they would send their sons to technical schools to prepare them for a trade. Every boy should have a sound knowledge of the underlying principles of his trade, for without it he can not become a thorough mechanic or be qualified to fill positions of responsibility.

ELECTRICAL WORKERS.

A belief that the school offered the fullest opportunity to obtain a good practical and theoretical education, a desire to become equal with companions in the same trade, and the convincing arguments of former students are reasons assigned for taking instruction in technical schools. While all the persons answering these inquiries

were employed during the time they were in school, yet the fact that they attended schools and commanded the support of the school authorities was the occasion of their securing higher positions and better remuneration.

The electrical business is so new that the trades are not generally organized and apprenticeships are not common. In some localities where apprenticeships are required the term is seven years.

Those who have been trained in technical schools are firm believers in that kind of education. In the school a pupil will inevitably learn how and why things are done much better than in a place where output is the chief consideration. Another great advantage is that he is thrown into contact with so many persons holding advanced opinions that he can not fail to be benefited thereby.

ELECTROPLATERS.

One graduate says that after six years' apprenticeship in a good shop he was convinced that he did not thoroughly understand the principles underlying the trade, and therefore he attended a technical school to perfect and broaden his knowledge. Another went to a school to learn the science of the trade because it could not be learned in a shop. One of the persons reporting is the son of an employer, and therefore did not have to depend upon any outside influence to secure and hold a position. Another says that the school authorities put him in communication with employers, and that the certificate given by the school was taken as evidence of his ability. His school training has resulted in higher wages and more rapid promotion than would have been the case otherwise, and he mentioned other graduates whose school training has brought equally good results.

Every boy should attend a good technical school to learn the scientific principles of the trade he wishes to follow. Technical instruction can not be efficiently given in a shop, because there is no time to devote exclusively to regular, systematic instruction.

MACHINISTS.

Generally speaking, the graduates reporting under this head had but one object in taking a course of instruction in a technical school. They desired to become finished workmen and to fit themselves to fill responsible positions in the trade, but in order to do this they found that it would be necessary to acquire a more thorough knowledge and training than could be had in the ordinary workshop. Some recognized, too, the general broadening influence of technical education of any kind, and felt that their evenings could not be better spent than in systematic study.

Nearly all the graduates were employed either as journeymen or as apprentices during the day, while pursuing their studies at night.

Those who attended day classes readily found employment when graduated. The school authorities generally interested themselves in finding positions for those who had none, and better ones for those already at work.

All graduates were obliged to serve an apprenticeship before being engaged as regular workmen, but in a few instances the time was from six months to two years shorter than the usual term. It is the unanimous opinion that their school training has resulted in higher and better-paying positions and more rapid promotion than would have been the case otherwise, and they are so well pleased with their own success that they are all either present or prospective patrons of the schools. Among the reasons which are assigned for sending a boy to a technical school are the following: The school gives a boy good groundwork in the principles of the trade; his mind is developed and he is lifted above the necessity of forever remaining just an ordinary workmen; school training is necessary to make a thoroughly practical workmen; it makes it easier to advance quickly in the shop; and it qualifies a boy to avail himself of many opportunities which otherwise would be closed to him.

MECHANICAL DRAFTSMEN.

A desire for better preparation for practical work and ambition to rise to high positions in the trade are the principal reasons given by this group of graduates for taking a course of instruction in a technical school. Most of them were employed in drafting rooms and saw the necessity for the theoretical training afforded by the schools, and some were advised by their employers to attend the evening classes. Nearly all have secured better positions as a result of their school training. It is customary to serve an apprenticeship of from five to seven years, but in some cases graduates were allowed a reduction of two years from the regular period. Having experienced the value of technical training themselves, these men would send their sons to a technical school to prepare them for a trade. In the school a boy gets the theory of his trade together with sufficient practice to demonstrate its application to actual work; his reasoning powers are developed and he is better prepared for the varying conditions of the shop. With shop training alone he seldom gets more than a vague knowledge of theoretical principles, and consequently is not so well qualified to advance in his trade.

PAINTERS AND DECORATORS.

Graduates in this trade attended technical schools to acquire a knowledge of the best technical methods and to make themselves proficient in high-class work. In some cases the fact that a course of instruction had been taken in the trade proved of assistance in securing

higher and better-paying positions than would otherwise have been the case. The term of apprenticeship is six years and this is not shortened by reason of school training.

Boys are advised to take advantage of trade and technical schools, because they can there get a better knowledge of the technique and of high-class work than can be had in the ordinary shop. Furthermore, it is said that a large percentage of the men engaged in the trade are not well grounded in the theory and science of it, and therefore are not qualified to give instruction, even though they are so disposed.

PATTERN MAKERS.

The men in this trade attended technical schools to gain thorough instruction in theoretical principles which would enable them to become more proficient and make more rapid progress in practical work. All were employed while attending school, but after completing their studies they secured higher and better-paying positions. The usual period of apprenticeship is five years and no allowance is made for school training. All these graduates are heartily in favor of school training for boys who are to engage in trades. It is said that in school a boy gets a good training in the theory of his trade and learns the best way to set about doing his work, besides getting a certain amount of practical knowledge which can not be had in the average workshop.

PLUMBERS.

Apprentices in this trade attended plumbing classes for technical instruction and to get a broader experience in practical work. This training has had a beneficial effect upon those who received it. One man says that when his employer found out the character of work he was doing in school he was immediately promoted to a better position at higher wages.

A formal apprenticeship of from five to seven years is required, which is shortened in some instances for those who attend a technical school, though labor unions sometimes object to this.

It is the general opinion that boys should attend technical schools, as they teach the use of tools and provide abundant material for practice work. The instructors are practical workmen, and the student gains a far better knowledge of the trade than can be acquired under shop training alone.

SHOEMAKERS.

The two graduates reporting for this industry had learned one or more of the operations in shoemaking before entering school. They attended school for the purpose of acquiring a technical knowledge of the various kinds of leather and the construction and operation of different kinds of machinery so that they might be qualified to fill

better positions. The desired result has been realized, both men having been promoted to positions as foremen, and in each case the promotion is attributed to the knowledge obtained in the school. They would send their sons to a technical school to prepare them for the trade, because they believe that technical training is necessary to enable a workman to apply his practical knowledge to the best advantage. Furthermore, the workman who has learned the operations of different machines as taught in the school has a better chance to secure steady employment and more rapid promotion.

TEXTILE WORKERS.

The reasons assigned for attending trade and technical schools may be summed up as follows: To get a general knowledge of the trade; to become more skillful workmen; to increase earning capacity, and to get that theoretical knowledge which can not be obtained in a mill.

All the persons reporting were engaged in mills while attending the schools, but the fact that they attended classes for instruction secured promotion for many of them.

The schools usually take a kindly interest in the success of their former students, and render them assistance whenever it is necessary, but it is rarely the case that a school-trained man has trouble to find desirable employment. A number of graduates were found who are occupying positions as overseers, foremen, and managers, and they feel that their success is largely due to their technical training.

Generally there are no formal apprenticeships in the textile trades. A youth goes into a mill and works as a weaver or spinner, or at whatever trade he wishes to follow, until he is qualified to do acceptable work. This may take seven years or it may be accomplished in a much shorter time.

Those who have attended these schools state that they would send their sons to similar institutions, because they believe that a properly equipped technical school is the only place in which a boy can obtain both theoretical and practical instruction. In the school he finds a combination of appliances which can not be found in any factory or mill, and he therefore has opportunities for information which would not otherwise be available, and he learns to perform his work in an intelligent manner. He gets a knowledge of every branch of the trade. While in the factory he rarely covers but one branch of it, being usually restricted to the part that best suits the needs of his employers, so that his chances for promotion are limited.

MISCELLANEOUS.

This group comprises graduates who are holding positions of responsibility as foremen, supervisors, and managers in various industrial establishments. Their object in taking a course of instruction was to

acquire a technical and scientific knowledge which would enable them to master the difficult problems encountered in every-day work and to place themselves in line for advancement in their particular trades. Some were working as ordinary mechanics in shops while attending school, and others were acting as assistant foremen, etc. Their technical training has resulted in promotion to higher and more remunerative positions, and they are among the strongest supporters of the schools.

The consensus of opinion is that all boys should be sent to technical schools to prepare for a trade, and that both apprentices and workmen derive great benefit from the evening classes.

The facilities afforded for investigating problems at night which the workman has not time to follow out during the day are invaluable to the man of small means, and these schools receive strong support from both employers and employees.

ATTITUDE OF LABOR UNIONS.

Some of the trade unions were at first suspicious of the technical schools, but by the exercise of some tact and by making some concessions the schools have won over to their side, as far as could be learned, every union. It is interesting to study the way in which this has been done.

The London Technical Education Board made careful inquiry in 1895 of 40 typical employers, with 12,000 employees in the building trades. They had only 80 formally indentured apprentices, and 143 so-called learners, who could be discharged at any time, instead of 1,600 apprentices, which would have been about the normal proportion. Some very interesting testimony on the building trades was taken in 1898–99 by a special subcommittee of the London Technical Education Board. It then appeared that rent was so high that employers did not think they could afford space at the bench for any except good workmen. Premiums of from £25 to £40 ($122 to $195) are required of an apprentice, and of course few can pay it. The trade is therefore chiefly recruited from the country, where men pick up a portion of the trade, secure employment in London, and thereafter in many cases improve their training at the technical schools. There are to-day nearly 3,000 students in the building-trade classes in London.

Although the trade unions admit to their membership those who have not formally served an apprenticeship, a few of them, particularly in the building trades, insist upon the schools being more restrictive than are the unions themselves. The plumbers' union, embracing 10,000 members, or about 80 per cent of all that work in London, opposed the admission to the practical workshop classes of all over 22 years of age, and of laborers who casually assist plumbers, no

matter what their age. From even theoretical classes they urged the exclusion of those who are not practical plumbers.

The London County Council has so far yielded to the unions and to the desires of many employers and teachers as to exclude from the practical evening classes, except in the artistic trades, those who are not at work during the day at the same trade. Neither carpenters nor woodcarvers are admitted to the joiners' classes in some schools. A plumbers' class of 40 threatened to strike if gas fitters were admitted, and the latter were thereupon excluded. A poultry farmer was refused admission to a carpentry class, where he wished to learn to do his own work.

The principal of the Battersea Polytechnic—one of the most progressive institutions in London—said that he confined his classes strictly to those engaged during the day at the trade, and would not admit a laborer, a son of a bricklayer, a builder's draftsman, a clerk in a builder's office, or any unskilled man to attend the practical classes in the building trades.

The subcommittee in making its report, however, advised that any learner or improver under 19 years of age, as those are called who are not formally apprenticed, should be permitted, if competent, to attend practical classes, and that mechanics in any branch of the building trades should be allowed to attend both the theoretical and practical classes in other branches of the building trades. These suggestions, or at least the second one, do not yet appear to have borne fruit in most of the London technical institutes. In two of them, however, the Goldsmiths' and the People's Palace, founded and controlled respectively by the Goldsmiths' and by the Drapers' Livery companies, with some help in the latter case from the old charities, but independent of the control of the London County Council, most of the practical classes are open to all who are competent to attend. Even in these schools the teachers prefer those in the trade and do not appear to have many others in their classes. It is said by many teachers of such classes that the amateurs, as those not in the trade are often called, may be more enthusiastic to learn than the others, but being ignorant of technical terms and unfamiliar with many things relating to the trade, they take up the time of the teacher with many questions which the trade students do not need to ask. The latter look down upon amateurs and often make their life in the class somewhat unpleasant.

There is a general desire among the London trade-unionists, even in the more restrictive printing and building trades, to encourage the better education in technical schools of those already in the trade, but there is little opportunity as yet for the London-born boy to get started at a trade or to learn a new trade if he finds at 20 or 22 that

he has mistaken his calling. In some of the restrictive trades, if parents can afford to send their children for day instruction, a youth can begin directly in school the use of the tools of his chosen trade, provided that his parents and he express their intention of his following that trade afterwards, and of taking an apprenticeship course in a regular workshop after leaving school.

In most of the technical schools outside of London, practical workshop classes, save in plumbing, are open to any who desire to take them, whether at work in the trade or not, and whether taking the school instruction by day or in the evening. Nevertheless the teachers agree with those in London in preferring to teach those at work in the trade, and they generally discourage somewhat the attendance of others.

The secretary of the Amalgamated Society of Engineers of England, the greatest trade union there, states that the majority of his organization, composed largely of machinists and metal workers, is in favor of opening the workshop classes to all who desire to enter them, and he thinks this is the opinion of the majority of English unions, while the opposite view is held only by such unions as are in other respects also very restrictive—for example, in not working with nonunion men, or in limiting the number of apprentices, etc. He states that the sentiment in favor of the schools and of this broader policy is steadily growing. In order to secure the friendship of the unions, the principals of some of the large technical institutions select trade-unionists of approved ability as teachers of their practical workshop classes, and one principal stated that he asked and accepted the advice of a certain trade union before selecting a teacher in their trade, but that such a policy when adopted by a principal is not revealed even to the governing body or trustees of the union.

BOOKBINDERS.

Technical schools are considered valuable to workmen, but there is a strong sentiment in some unions against the schools admitting any persons as pupils except those actually engaged in the trade, and some of the schools have been waited upon by deputations from unions urging such a course. The unions have not assisted the schools financially, but they have in some instances advised with the school authorities concerning the selection of teachers. There is a fear in some quarters that the schools may turn out partially trained, cheap labor, and until the results in this direction are seen some of the unions decline to take any decided attitude.

The number of apprentices is not universally limited, but where there is such a limit it is fixed at 1 apprentice to 3 journeymen. The nominal term of apprenticeship is seven years, but there is large provision for exceptions. No provision is made for shortening the

apprentice period on account of school training, but if such a need should arise the unions would act equitably.

Under present shop conditions it is almost a necessity that a boy should attend a school. The tendency and practice in the shops to keep a boy on one or two subdivisions of the trade prevents him from becoming proficient in the trade as a whole. Employers solemnly engage to teach a boy his trade, and then use him for their own profit by making him efficient in one or two of the simplest operations only. This kind of training must necessarily be supplemented by the schools to enable the apprentice to learn the more complicated and delicate operations of his trade.

One drawback to the usefulness of evening schools is the difficulty of keeping the average boy up to the mark of attendance. After a day's hard work he is often not inclined to go a long distance to school and take up an evening task.

BOOT AND SHOE WORKERS.

Union officials in some localities are members of the advisory committees in trade and technical schools, but the unions as bodies do not interest themselves in them, though such schools are regarded as giving valuable instruction.

Where there is any limit to the number of apprentices it is 1 boy to 3 men. The term of apprenticeship varies greatly, according to custom and the branch of the trade engaged in, ranging from one to seven years. The term is not shortened by reason of any previous school training.

CABINETMAKERS.

Cabinetmakers are very friendly to trade and technical schools, and their unions give them encouragement. One union was instrumental in starting evening classes for cabinetmakers in the technical school of its home city. Another recommends its members to send their children to technical schools on the ground that apprentices do not receive proper attention in the shops.

Wherever the unions fix a limit to the number of apprentices it is 1 to each 4 journeymen for cabinetmakers, and for wood carvers 3 apprentices are allowed to each shop. The usual term of apprenticeship is five to six years. This term is not shortened on account of any school training a youth may have had.

CARPENTERS AND JOINERS.

Trade, technical, and continuation (night) schools are considered valuable, but there is not that importance attached to them that is found in some other trades. While they are very useful to the industry, the workman is thought to gain less advantage than the employer.

The unions have not uniformly given either moral or financial aid to the schools, and some think the public funds set apart for this purpose are not used for the interests of workmen so much as they should be. Not many union officials personally oppose the schools, but some of them criticise their work. These say that the schools teach only a part of the trade and that there is a tendency to make machines of the students.

Where there is a tendency among employers to use much cheap labor, an attempt is made by the unions to limit the number of apprentices, but there is no general rule as to this point. The usual term of apprenticeship is five years, though this is sometimes extended to six years in case the apprentice begins his service at the age of 15. The time spent in school does not count in the term of apprenticeship, as a rule, though there are instances in which it has been recognized to some extent.

It is argued in favor of the schools that a boy may learn that which he would not have an opportunity to learn in the shop; he is enabled to grasp more readily the practical requirements of his trade; and he will, by reason of his technical education, have an advantage over the masses of workmen. On the other hand, it is said that the trade must be learned in the shop because the schools do not adapt their work to the practical needs of the students. Some good comes from the schools, but there is much room for improvement.

COACH MAKERS.

The unions and individual members generally are friendly to trade and technical schools, and regard them as valuable to the workingman. In some localities the unions require an apprenticeship of five years, and limit the number of apprentices employed in the trade.

Leading officials say they would send their sons to trade or technical schools to prepare them for a trade, for the reason that the theoretical and technical instruction afforded by such schools helps a boy to readily understand the practical part of his trade, thus enabling him to become a better workman.

FARRIERS.

The secretary of the single union reporting is strongly in favor of technical schools. He states that they are held in high esteem by farriers, and while no instance is reported in which their unions have given pecuniary aid to such schools, they give them their moral support and many members attend the classes. The number of apprentices is not limited, and there is no fixed term of apprenticeship, but it usually requires five years for a learner to become a competent workman.

A boy should most certainly attend a technical school. He there learns the theory and scientific principles of his trade, besides having broader practice.

MACHINISTS AND METAL WORKERS.

Schools that maintain night classes for the purpose of giving theoretical and technical instruction in trade work are considered by the representatives of these trades to be valuable to the workmen. A number of unions give such schools their moral support and some offer special inducements to encourage the attendance of members and their sons. In Birmingham the brass workers' union donates an annual prize of 3 guineas [$15.33] to the local school and recommends its members to join the classes in brass work. In the same place the gun workers' union encourages boys to attend the school by paying their tuition fees and providing prizes for regular attendance and excellent work. In the Birmingham district, also, prominent members of the engineers and machinists' union deliver lectures on engineering subjects in the schools. In Sheffield the engineers' and machinists' union gives two prizes annually to sons of members attending science and art classes in the local technical school. In some places the unions limit the number of apprentices employed in the trade and fix the period of apprenticeship at five years. In most localities, however, there is no restriction regarding the number of apprentices employed, nor is there any fixed term of apprenticeship, but custom usually calls for four or five years' practical experience before a man is considered a qualified workman. In no case is it stated that a course in a technical school shortens the term of apprenticeship. The idea seems to be to have apprentices attend the schools for the purpose of acquiring a technical knowledge which will enable them to become better workmen and not with a view to shortening the time of preliminary shop training.

Many union officials patronize trade schools, and all state that they would do so if they had sons desiring to learn a trade. It is said that the boy who has a scientific knowledge of his trade is better able to grasp the problems that arise in his work; he is trained in appreciation of the beautiful in design; he is better able to see causes and effects, and his work is therefore made easier.

PAINTERS AND DECORATORS.

Technical education is in general favor among painters and decorators, and some of the unions encourage the schools with hearty moral support. In one place the union induced the governing board of the local school to provide instruction in this particular trade. The unions generally limit the number of apprentices, but this limit varies in different districts. Perhaps a fair example of the limit is 3

apprentices to 20 journeymen, and a maximum of 5 to the establishment, regardless of the number of journeymen. The term of apprenticeship begins usually when a boy is 16 years old and ends when he is 21. This period is not shortened on account of any time spent in school.

It is the general opinion that apprentices should attend a technical school because of the larger opportunities afforded for acquiring both theoretical and practical knowledge, which on account of the subdivision of shop work can not be satisfactorily acquired by shop training alone.

PATTERN MAKERS.

Most of the pattern makers regard technical schools as valuable to their trade, but there are some who consider them as useless. The unions generally seem to hold an indifferent attitude toward the schools, and where support of any kind is given, it is only moral. A majority of the unions do not limit the number of apprentices, but they fix the term of apprenticeship, usually at five years.

Those who would patronize the schools would do so to enable their sons to acquire theoretical knowledge. One says he would not patronize a trade school because often the teachers are not practical and the boy would be confused when he had to unlearn in the shop what he had been taught in the school.

PLASTERERS.

The information for this trade was furnished by a prominent official of the National Association of Operative Plasterers. He states that trade, technical, and continuation (night) schools are all considered valuable to workingmen. The association has never contributed money to the schools, but it has given them moral encouragement, and its secretary managed the drawing and modeling classes in a school two seasons without compensation. There has never been any opposition to the schools, but unless all students are actually working at the trade, or intend to do so, support is withheld.

The number of apprentices is restricted to 1 to 4 journeymen. The apprentice must enter the trade by the time he is 16 years old and remain until he is 21. This rule, however, is not strictly enforced in all localities. All boys who intend to follow a trade for a livelihood should attend a trade or technical school, as they would there learn the theory and science of the trade and would therefore make better progress in practical work.

PLUMBERS.

Representatives of plumbers' unions regard technical instruction as valuable to workingmen, but their expressions are more or less qualified. One would have night schools only because the day schools tend

to produce what he terms "illegitimate apprentices;" another would prefer training, particularly in sectional work; and another still would confine the schools to those students who are bound apprentices. While the unions do not oppose the schools, they have not generally given them substantial aid. One union, however, was found which has materially assisted in the establishment of technical classes for apprentices and young journeymen, and many individual plumbers patronize the schools.

In England the unions generally limit the number of apprentices, while in Scotland the opposite is true. The term of apprenticeship varies according to locality. In cities and large towns, where a higher class of work is demanded, the term is longer than in smaller places, ranging from five to seven years, and it is not shortened by reason of any time the apprentice may have spent in school.

It is the general opinion that every boy who desires to learn a trade should either take a course in a technical school before entering the trade or supplement his shopwork by theoretical instruction in the night classes. The school would give him the opportunity to become skilled in special branches and he would receive such instruction as would better fit him for his calling. In these days of keen competition a young man has little prospect of advancement unless he has had technical training, and in the small towns particularly it is impossible for the apprentice to get adequate instruction regarding modern methods of plumbing or sanitary appliances without attending school.

PRINTERS.

Representatives of typographical unions generally regard trade, technical, and continuation (night) schools as valuable to workingmen. One says that they are of the very highest value. Another believes they are valuable, but thinks they should confine their teaching to those already engaged in the trade. Still another regards them as valuable in a few cases, but not generally. Most of the unions give the schools their moral support, and one gives a prize to the most successful student member and makes an additional donation to the prize fund of the local school. This union has been instrumental in placing a Linotype machine in the school of its locality. Members of unions are instructors in some of the schools.

The unions limit the number of apprentices, but the limit is not uniform. Some fix the number of apprentices at 1 for each 3 journeymen, while others fix the number at 3 to a shop. The regular prescribed term of apprenticeship is seven years. One official says that often a boy is kept three or four years in a shop before his time counts, and in such cases the apprenticeship extends over ten or twelve years. Trade-school graduates serve as long a term as those who have never attended the schools.

All of the union officials answering these inquiries state that they would patronize technical schools if they had sons who desired to learn a trade, and, indeed, many have sons attending such schools. The schools afford means for obtaining knowledge supplementary to that gained in the shop during apprenticeship. A boy is not expected to learn a trade from the knowledge gained in a technical school, but with this knowledge he is better equipped than are those without it, and he will rise higher in his trade. Technical training should continue after starting to work in order further to improve the mind.

TEXTILE WORKERS.

Officials of unions representing various textile trades uniformly regard trade and technical schools as valuable to workingmen, and some regard them as absolutely necessary. A majority of the unions give moral support to the schools and some are liberal in giving pecuniary aid. When one of the most successful trade schools was started it was a cooperative institution and the president and secretary of the local spinners' association were regular contributors whenever there was a call for financial aid. One weavers' society gives eight yearly scholarships of £1 ($4.87) each to the school of its town, and a weavers' association in the same town gives £20 ($97.33) annually to the school. Large numbers of the members of unions attend the schools, and this is perhaps the strongest evidence of the high esteem in which they are held by the workmen in general.

In most of the textile trades there seem to be no apprenticeships, as that term is commonly understood. In some localities, however, there is a fixed period of service before a learner is permitted to receive full pay. This period varies from two to five years, and in one instance it is stated that the time from a boy's entrance into the mill as a "half-hand" until he is a fully qualified spinner will approximate nine years. The custom seems to be that whenever a learner becomes proficient he receives full pay without regard to the length of his services.

A number of the labor union officials who answered the inquiries are patrons of technical schools, and all say they would be if they had sons who wished to learn a trade. All trades are becoming more and more technical and more highly skilled artisans are in demand. Technical schools are the connecting link between the common schools and the workshop. The theoretical and scientific principles underlying a trade are taught in the schools, and the youth learns the reasons for doing or not doing his work in a particular manner, his judgment is quickened, his industrial vision is broadened, his labor is lightened, and stability is added to his character. He becomes less a machine, his new knowledge gives him added power, and he is better fitted to profit by his shop experience. In the shop a youth receives no more

assistance than those over him are forced to give, and his school training makes him in a very large measure independent of them. In the school he may fit himself for any department of his trade, while in the shop this is very difficult.

UPHOLSTERERS.

Technical schools are regarded as very valuable to young shop hands, and the unions have given them their moral support. The unions have never opposed the schools, except where they have attempted to interfere with trade customs—such, for instance, as introducing women into positions held by men.

The number of apprentices is limited to 1 boy to 3 men, and there is a tendency to make the limit more stringent by fixing it at 1 to 4 or 5. Custom fixes the apprenticeship period at five years, but there is no specific rule to that effect. The fact that a young man attends a school does not shorten the period he must serve as an apprentice.

The secretary of the union reporting says he considers it a duty to send a boy to a trade or technical school, but he would not do so until he was apprenticed at his trade. The upholsterer who makes a mark in his trade is the one who supplements his shop training by school instruction. In the school he learns drawing and design and gets an insight into other branches of the trade, such as cutting and fitting, which not one apprentice in a hundred is taught in the shop.

MISCELLANEOUS.

This classification includes a number of labor unions from which the data obtained were too incomplete to be used in separate statements. The individuals representing these trades are all very favorably disposed toward the system of technical trade instruction which has been established in England, and they are of the opinion that the schools afford a decided advantage to apprentices and workingmen generally. By some they are declared to be indispensable. The bricklayers, electrical workers, goldsmiths and jewelers, sheet-metal workers, iron founders, and paper-mill workers reporting all give moral support to the schools; many electrical workers attend the night classes; and the goldsmiths and jewelers and paper-mill workers advertise the schools and advise their members to attend them.

None of these unions opposes technical schools, but electrical workers insist that only those engaged in the trade should be taught. All unions except leather workers and paper-mill workers limit the number of apprentices. Goldsmiths and jewelers fix the number at 1 to 6 journeymen, and iron founders usually allow 1 apprentice to 3 molders. With bricklayers each local union fixes the term of apprenticeship, but the time for beginning must not be later than 18 years of age; tin-plate and sheet-metal workers require six years; electrical

workers from three to five years; electrotypers and stereotypers seven years; goldsmiths and jewelers require six years, but sometimes accept five; iron founders stipulate that an apprentice may enter at 14 and must have entered at 16 years of age in order to complete his term of apprenticeship by the time he reaches 21, thus making the term from five to seven years. In no case is the term of apprenticeship shortened on account of school training.

It is the general expression that the technical schools offer valuable and necessary theoretical training which can not be had in the shops, and practically all the representatives of these unions say that they would send their sons to such schools if they wished to prepare them for a trade.

CHAPTER IX.

TRADE AND TECHNICAL EDUCATION IN HUNGARY.

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TRADE AND TECHNICAL EDUCATION IN HUNGARY.

INTRODUCTION.

Hungary was not originally included among the countries whose systems of industrial education were to be covered by the present report. A comprehensive report on the Hungarian industrial and trade schools, however, was published in 1900 by Mr. Josef Szterényi, royal councilor and chief of the division of industrial and commercial education in the department of commerce at Budapest, and it is thought that the inclusion of the parts bearing more particularly on the classes of schools covered by the present report will be of interest as supplementing the more extended account of the Austrian schools. A brief digest of the report of Mr. Szterényi was translated for the report of the United States Commissioner of Education for the year 1899–1900, and use is here made of that translation.

Industrial instruction in Hungary—that is to say, instruction tending to foster industries—reaches back several centuries, to the time when Christianity was introduced into the country. The first beginnings of industrial instruction are found in the convents, especially in those of the Benedictines, who maintained regular workshops, each of which was the nucleus of a school in which knowledge of trades, skill in their pursuit, and love for industrial labor were fostered. The first explicit information about these schools reaches as far back as the thirteenth century, in which, among the monks, a number of skilled architects were noted. Several now existing architectural monuments were planned and executed by Benedictine monks.

From the convents instruction with industrial tendencies spread to the cities, where in the fourteenth and fifteenth centuries several schools were maintained in which all the branches were taught that were considered essential for commercial and industrial life. However, instruction with a decided industrial tendency may be said to have commenced with the introduction of systematic instruction in geometry, which took place during the sixteenth century. During the seventeenth century geometry was fittingly supplemented by the introduction of drawing. This branch was particularly promoted by the order of the Piarists, who already taught architecture and industrial drawing.

While during the preceding centuries industrial instruction was chiefly fostered in convents by religious orders, it became general in Hungary during the eighteenth century, and the entire educational system was organized chiefly under the initiative of Empress Maria Theresa. She gave the impulse to the organization of State institutions of learning in 1774, but previous to that, in 1770, the Royal Drawing School at Budapest was organized; this is the first secular school of that kind in Hungary.

The new school organization was published in 1777. It required that every city should organize a national school in which drawing was to be an obligatory study, but other studies also were to consider industrial and commercial relations; this is plain from the fact that it was ordered to teach arithmetic with applications to commercial and industrial pursuits.

In 1779 a first attempt was made in Hungary to establish an industrial school combined with a workshop; that is, at a time when scarcely any of the Western nations had any, or at least very few, of such institutions, though these nations were much further advanced industrially and commercially.

At the same time humanitarian institutions, such as schools for deaf mutes and blind, promoted industrial pursuits by teaching certain trades, such as bookbinding.

In 1783 a noteworthy decree was published by the Government which required of cities the establishment of Sunday drawing schools, making it obligatory for apprentices in workshops to attend them regularly. This decree was accompanied by a detailed course of study in drawing with explanatory remarks. A court decree of 1795 made the one of 1783 more effective.

This second decree stated that upon penalty no master was allowed to receive a boy as apprentice unless he had passed through the elementary school, and that every apprentice should attend the Sunday drawing school for at least a year, otherwise he could not obtain his certificate of having completed his apprenticeship. Journeymen, also, were obliged to attend these Sunday schools for a year, for without a certificate of attendance upon such a school they could not become master workmen. Heavy penalties were inflicted if a journeyman had been admitted by any guild as master without having proved by documentary evidence that he had enjoyed a year's instruction in drawing.

In consequence of this royal decree instruction in drawing became general among apprentices and journeymen, and hence industrial instruction received a uniform organization.

This was the status of industrial education during the first half of the nineteenth century. At the close of this period a unique system of lower trade schools was established in Budapest and a few provin-

cial cities in which apprentices were taught partly on Sundays, partly in the evenings of work days, reading, writing, arithmetic, bookkeeping, and drawing. At about the same time the capital city, Budapest, established a higher industrial school, which years afterwards developed into the present polytechnicum.

The history of the system of special schools in Hungary during the nineteenth century is very rich in changes. The necessity of systematic instruction for industrial people made itself felt; both the State Government and society felt it. This led in 1872 to the passage of a law which made it a duty of apprentices to attend regularly so-called apprentice schools, and the law of 1884 made it a duty of communities to establish and maintain such schools whenever in any community there are 50 apprentices working in shops or factories; and the masters of trade are obliged to procure their attendance at these schools.

But the Government was not satisfied with the inauguration of lower evening and holiday schools. It was found of eminent importance to provide for schools in which foremen and masters of trade should be educated, to whom the special education of apprentices could be intrusted. Several schools of this kind were established for different branches of industry, such as for weavers, wood and metal workers, and for the ceramic industry; these schools furnished a considerable number of experts. But while all industrial schools were at first the result of private initiative, they afterwards became State institutions with the exception of apprentice schools, which through the law of 1884 were, and remained, communal or local institutions.

The following table shows the great increase in the expenditures on the part of the State for industrial schools:

EXPENDITURES FOR INDUSTRIAL SCHOOLS, 1868 TO 1897.

Year.	Through the department of commerce.	Through the department of education.	Year.	Through the department of commerce.	Through the department of education.
1868	$500		1883	$22,345	$57,093
1869	1,500		1884	28,412	65,051
1870	2,600		1885	24,108	83,399
1871	2,705		1886	26,408	83,911
1872	2,450		1887	28,121	90,351
1873	3,200		1888	19,378	89,507
1874	9,400		1889	20,041	83,947
1875	5,012		1890	23,526	80,421
1876	8,363		1891	32,592	86,050
1877	8,230		1892	38,232	91,043
1878	8,042		1893	90,025	98,127
1879	8,600	$12,499	1894	127,701	104,863
1880	8,860	12,710	1895	144,846	90,000
1881	7,792	23,865	1896	175,500	95,500
1882	16,694	42,002	1897	242,500	37,700

From these data it is seen that the State has increased its expenses for industrial education five hundred and sixty fold within thirty years. But it should be borne in mind that the State is not the only agency that supports this special education; cities, counties, and towns, and

particularly chambers of commerce and industry, pay annually large sums for the same purpose. In 1895–96 the apprentice schools alone had cost the communities $254,297, of which sum the State paid nothing.

Thus, in briefest possible outline, the most important points are stated concerning the history of industrial education in Hungary; but enough has been said to show that the country is doing its duty in the field of special education in the interest of national economy, and a glance at the present conditions may serve to show in detail how these schools are managed and what they attempt.

Industrial education is organized in a complete system, all the parts of which are organically connected. Its organization is uniform though it makes allowance for local conditions and needs. It is divided into two main parts, (1) apprentice schools and (2) technical schools proper. The former are under the control of the department of education, the latter under that of the department of commerce, which latter has a special bureau for industrial education, the chief of which is the royal superior-director. But both departments, that of education and that of commerce, have supervision of all the schools devoted to industrial education. Essential changes in the course of study can be made only upon agreement of both departments. In order to obtain the best possible advice concerning questions of organization, curricula, choice of text-books, and devices for teaching, a board is appointed, called the State industrial school board, consisting of 32 members, partly professional industrial teachers, partly manufacturers and merchants, and some professors of the Royal Polytechnicum. This board is the highest advisory authority for the system of industrial schools. It is independent of the two departments, and acts under authority of a statute approved by the King.

The teachers of apprentice schools are usually teachers of common elementary, and high schools, who teach in these evening and holiday schools for a small additional salary. The technical schools proper all have regular faculties, the members of which are regarded as State officers. The professors in schools for woodworkers, weavers, metal workers, and machine builders are graduates of the department of mechanical engineering in the polytechnicum; those in schools for stone workers and masons are sculptors and architects; those in schools for the ceramic arts are chemists, sculptors, and modelers. Each one of these teachers is sent abroad for a year or more at the expense of the State, before he is appointed definitely, to study his branch in noted schools of other countries, or he is sent to a university to enter as a student of a special branch. The professional preparation of foremen and work superintendents appointed in these schools is provided for in the same way. The department of commerce sends annually a number of these teachers abroad to study the condition of the trades

which their schools represent, and to visit schools of similar character, so that every teacher has a year's travel to study after three or four years of work.

The system of industrial schools consists of (1) apprentice schools; (2) journeymen's schools; (3) trade schools; (4) industrial technical schools; (5) higher industrial schools; (6) women's industrial schools; (7) industrial drawing schools or schools of design; (8) one public lower industrial school; (9) schools of general culture in which some industrial branches are taught; (10) industrial museums.

APPRENTICE SCHOOLS.

These form the lowest step of the system and are under the control of the minister of education. Attendance at these schools is obligatory; it was made so by the law of 1872. Formerly attendance on the part of apprentices was obligatory only where such schools existed, but since 1884 the cities and towns having at least 50 apprentices were obliged to establish such schools and make attendance obligatory. Masters of shops and owners of factories failing in their duty to send their apprentices to these schools are liable to fines of 50 florins ($20.30.)

The law provides that the city or town councils must establish and maintain apprentice schools; the expenses are to be defrayed from fines and a special tax not exceeding 2 per cent of the State school tax. In cases where these sources are inadequate special subsidies are granted by the minister of education. County funds are established, the interest of which is used to support these schools. In urgent cases, even the capital may be used to establish them.

Every trade apprentice is obliged to attend these schools during the entire time of apprenticeship. They have three grades, and a boy may enter at 12 years of age, after having gone through the elementary school; but since many boys fail to go through the entire course of the elementary schools, many apprentice schools are obliged to have preparatory classes.

The instruction takes place in the evenings and on holidays, and is given seven hours per week—two hours each on two week days, and three hours on Sunday. The three hours on Sunday are exclusively devoted to drawing. The branches of instruction are (1) the mother tongue, (2) geography, history, and nature study, (3) penmanship, (4) arithmetic and bookkeeping, (5) drawing and sketching. The course is given in detail by the central Government. If the religious communities desire to have these apprentices taught religion, they may do so, but they must do it at their own expense. In order to make these schools very effective, special courses for teachers are arranged. In 1895-96 Hungary had 366 apprentice (evening and holiday) schools with 72,676 pupils and 2,150 teachers. In places where there are not

enough pupils (50 to begin with), apprentices are obliged to attend the elementary continuation schools till they are 15 years old. The city authorities appoint a special inspector, usually a professional teacher, who reports upon the condition of the apprentice schools to the city council as well as to the State government. The Government inspects the schools through its own functionaries.

SCHOOLS FOR TRADE JOURNEYMEN.

These schools are advanced apprentice schools; attendance in them is not obligatory, but they are well patronized in cities. Their maintenance depends partly on tuition fees and partly on contributions of city and State governments. The number of such schools is about 20 in the whole State; they have about 1,000 students, and are supervised like the apprentice schools.

SCHOOL WORKSHOPS.

The workshops for apprentices form the second step of the industrial school system, but the first step of the system of technical education. They belong to the department of commerce. Their object is to supply the trades with skilled laborers and particularly aid the industries known as home industries in contradistinction to factory industries. The course is one of three years, except for boys preparing for special branches of work, for whom extra courses are arranged, lasting from three months to one year. The three-year courses are both theoretical and practical, chiefly practical, of course. In drawing and designing much valuable work is done. About ten hours a week are devoted to theoretical instruction and about forty hours a week to practical application. Boys must be 12 years of age to be admitted and must have completed the course of the elementary school. These school workshops differ from the manual training schools in this: They teach one or at most two trades, while in the manual training schools no trades are taught, but the use of tools and material is aimed at. In Hungarian trade workshops no theoretical instruction is given to boys who come to perfect themselves in certain branches of home industry.

Besides these workshops conducted as schools, there are a number of factory work schools, maintained by the owners of factories who intend to prepare their own workmen for special work. The workmen, chosen by the foremen or owners of the factory for the purpose of attending school, are paid like regular workmen.

Beside these, there are school workshops of a peculiar nature called wage work schools. The students of these take material home and bring the completed work to the institution. School workshops are connected with the following industries: (1) Weaving, (2) braiding, (3) stone working, (4) toy industry, (5) lace making, (6) ceramic industry.

INDUSTRIAL TECHNICAL SCHOOLS.

These technical schools are the youngest branch of the industrial school system and the most promising type of practical schools. They form the third step of the system, and their chief object is to aid Hungarian industry by preparing well-equipped laborers of a high order who can act as master workmen and directors of factories. These technical schools are to develop handicrafts by degrees into art industry (that, at least, is the intention). This necessitates, of course, a systematic, theoretical, and practical education. Each of these schools is provided with the necessary power machines.

The course is one of four years, except in the weaving schools, where it is of two years, and the locksmith's school, which has a three years' course. The theoretical instruction claims from four to eight hours a week, drawing from fourteen to eighteen hours, and instruction in workshops from twenty to thirty hours, so that the whole number of hours of work per week is from fifty to fifty-two. The theoretical lessons embrace general and technical branches, as is seen from the following schedule. To this must be added from twenty to thirty hours' shopwork per week.

SUBJECTS TAUGHT AND HOURS PER WEEK DEVOTED TO EACH, HUNGARIAN INDUSTRIAL TECHNICAL SCHOOLS.

Subjects taught.	Schools for wood-workers.				Schools for metal workers and machine builders.				Schools for stone-workers and clay modelers.				Schools for textile workers.	
	1st year	2d year	3d year	4th year	1st year	2d year	3d year	4th year	1st year	2d year	3d year	4th year	1st year	2d year.
GENERAL SUBJECTS.														
Language (mother tongue)	2	2	1	1	4	3	3	1	2	2	1	1	2	1
Arithmetic	2	2	1	1	4	3	2	.....	3	2	2	1	2	2
Geometry	2	.....	.....	.....					2	.....	.....	.....	3	2
Geometric drawing	4	.....	.....	.....	8	.....	.....	.....	4	.....	.....	.....		
Working drawing	.....	6	.....	.....					6	.....	.....	.....	.....	.....
Free-hand drawing	4	4	4	.....	6	.....	.....	.....	6	6	6	9	4	4
Modeling	4	.....	.....	.....	.....	.....	.....	.....	4	4	4	4	.....	.....
Bookkeeping	.....	.....	3	.....	.....	.....	.....	2	.....	.....	.....	2	.....	1
Physics	2	.....	.....	.....	1	6	.....	.....	2	.....	.....	.....	.....	.....
Chemistry	2	.....	.....	.....	1	7	.....	.....	2	.....	.....	.....	.....	.....
Penmanship	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
TECHNICAL SUBJECTS.														
Construction	5	6	10	14	.....	12	12	12	.....	.....	6	6	.....	.....
Technology	5	2	2	2	.....	2	3	3	.....	.....	2	.....	2	1
Architectural geometry	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....
Machine construction	.....	.....	.....	2	.....	2	2	3	.....	.....	.....	.....	.....	.....
Stone lettering	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
Chemical laboratory	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	4	6	3	7
Textile technology	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	4
Decomposition	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	4

The conditions of admission to these schools are as follows: The applicant must have completed his twelfth year of age, and either have completed the elementary school course or the two lower grades of a high school. In exceptional cases graduates of the apprentice evening schools are admitted. The weavers' schools admit only boys 14 years

old. Many of the technical schools are boarding schools, having ample dormitories.

At the close of the course the students receive a diploma, which facilitates their employment and enables them, after two years' practical work as journeymen, to become master workmen. State factories and railroad shops prefer to employ the graduates of technical schools.

The schools for the building trades differ in essential points of organization from those described in the foregoing. They are not independent technical schools, but connected with some other industrial institutions. Their courses are either three whole years or four winter semesters, and during the building season the students are engaged in practical work. The graduates are only journeymen in their trades; to become masters in brick or stone masonry, stonecutting, or carpentry several years of practical work are required and a final examination before a trade board of examiners. Students who pass the four years' course in school may acquire the right to act as masters after another four years of practical work without examination.

The following industrial schools are found in Hungary:

1. Two State schools for wood workers in Homonna and Ujpest, in which cabinetmakers, turners, and wood carvers are prepared. Number of students in 1895–96, 17 and 14, respectively.

2. Four schools for the wood and metal industry in Arad, Klausenburg, Maros-Vásárhely, and Szegedin. Besides the branches taught in (1), there are taught branches for locksmiths, art workers in wrought iron, and machine builders. In one of these schools (Klausenburg) stokers of engines and others are also taught. The 4 schools have together 318 students.

3. There are 2 schools exclusively devoted to metal work, situated at Budapest and Gölniczbánya; number of students, 77.

4. There are 2 weaving schools in Kesmark and Heltau. The former applies itself to both hand weaving and mechanical weaving; the latter is devoted to wool weaving exclusively; number of scholars, 23.

5. There are 3 schools for stone workers and the ceramic arts in Udvarhely, Zalathna, and Unghvar. In these schools stonecutting, ornamental sculpture, clay pottery, tile making, and stone polishing are taught. The number of students in 1895 was 100.

6. There are 2 watchmakers' schools at Budapest and Klausenburg; number of students, 47.

7. The leather industry is represented by a school at Seben, in which chiefly shoemaking and saddlery are taught; number of students, 11.

Hence there were in Hungary, in 1895–96, 16 industrial schools, with 616 students.

In this connection it may be mentioned that a number of advanced burgher schools have opened workshops in which the boys are induced to occupy themselves with trade work, but, though heartily supported

by the Government, the idea did not find a like support among the people and with teachers who think that the general education offered in such schools should not be burdened with prosaic, so called, practical occupations. At first such shops were established quite numerously, but of late they have been abandoned, so that in 1895–96 there were only four schools of that kind left. It is generally thought best to let the children obtain a thorough elementary education, and after that induce them to enter practical pursuits in purely industrial schools.

STATE INDUSTRIAL SCHOOLS.

As the highest step of the system of Hungarian industrial schools below the polytechnicum at Budapest may be regarded the State industrial schools. They are advanced institutions aiming at a thorough preparation of foremen and factory owners. Their course is one of three years, but it has been found desirable to increase it to four years. Applicants for admission must have graduated from a burgher school or have passed through the four lower grades of a secondary school. In some of these schools practical experience in shops is required also. The students who pass the examination for graduation are thereby not only entitled to an abridgment of their military service to one year, but also to a preference in the appointment to subordinate offices in postal, telephone, railroad, and customs bureaus.

The best feature of these schools is found in the excellent facilities for practical shopwork offered the students. These shops are built on a large scale and contain the latest technical inventions. The organization of these schools is uniform except that in their time tables they differ, but only in so far as the local conditions require. Of the forty-eight to fifty hours per week of instruction twenty to twenty-six are devoted to shopwork. Instruction is not gratuitous, but tuition fees are paid.

The school at Kaschau is chiefly devoted to mechanics and machine construction, but teaches also electro-technique and political economy.

The school at Budapest is the largest institution of this kind in eastern Europe, having five distinct departments: (1) Architecture, (2) mechanical engineering, (3) chemistry, (4) metal work, and (5) wood industry.

The theoretical branches taught to the students of all the five departments are: Hungarian language, arithmetic, geometry and algebra, physics, chemistry, free-hand and instrumental drawing, machine construction, political economy, and bookkeeping. Each department of this school has, of course, its own course of study in practical work. The following lists will show how thorough that work is:

Course in architecture: Architecture, architectural drawing, modeling, architectural geometry, materials, foundation laying, surveying, building mechanism, theory of construction, making estimates, bridge and hydraulic engineering, history of architecture, and practical shopwork.

Course in mechanical engineering: Drawing from nature, mechanics, technology of wood, machine construction, constructive drawing, technology of metal, agricultural machinery and its drawing, surveying, railroad machinery, mill building, paper mills, electro-technique, and twenty-one hours a week practical shopwork.

Course in chemistry: Modeling, general chemistry, inorganic chemistry, laboratory practice, organic chemistry, mechanical drawing, inorganic and organic technology.

Course in metal industry: Free-hand drawing from nature, mechanics, locksmithing, simple iron construction, modeling, heating and ventilation, wells, pumps, fire engines, waterworks, electro-technique, and twenty-four hours a week shopwork.

Course in woodworking industry: Modeling, drawing from nature, technology of wood, theory of construction, constructive drawing, and twenty-three hours a week shopwork.

The number of teachers in 1895–96 was 232. There were, in addition to these day courses, a number of special winter courses, one for the building trades with 143 students, and one for stokers and engineers for stationary and locomotive engines, with 800 students. Only men engaged in factories and shops are admitted.

A small State industrial school for joiners is situated in Kronstadt, the chief subject of study of which is artistic wood carving.

INDUSTRIAL SCHOOLS FOR WOMEN.

These institutions have the purpose of preparing women for suitable occupations or wage working. Their organization is uniform in essentials. Admission is granted only to those who have completed an elementary school course. In some of these schools for women theoretical instruction is given, which is, however, confined to the three branches, language, arithmetic, and bookkeeping. Drawing is taught in every one of these schools for women. The course is one of two years, and tuition fees are charged. There are eleven of such schools, some of which are subsidized by the State, others are private or municipal schools.

INDUSTRIAL DRAWING SCHOOLS.

In other countries, notably in the United States, such institutions are called schools of design. This branch of the Hungarian industrial-school system is the most modest of all, comprising only a few institutions. Their object is exactly that of other schools of this kind in Germany, France, Austria, and the United States, namely, to raise industrial art to the highest possible perfection by inventing new designs and new modes of introducing art into industrial pursuits. In 1895–96 these schools of design had 1,083 students, of whom only 91 were women.

LOWER INDUSTRIAL SCHOOLS.

At present there is only one school of this kind. It is located at Temesvar. It prepares young boys for entering shops as apprentices. It has 238 students. It is the intention of the Government to

raise this school to the dignity of a secondary school as soon as the funds available reach an amount which will permit doing so.

MANUAL TRAINING SCHOOLS.

Schools of this kind are so well understood in this country that a description of course and organization is not necessary. There were only four of them in Hungary in 1895–96. Separate buildings are used for the boys, who come from their day high schools for a specified number of hours per week to get instruction in cardboard and wood work.

INDUSTRIAL MUSEUMS.

These museums are mentioned last because they are not, properly speaking, schools, but aids for all industrial schools of the State. There are four of them—in Budapest, Maros-Vásárhely, Klausenburg, and Seben. A general exhibition of all industrial arts is open all the year round; special exhibits of the products and methods of separate trades are arranged for in each of these museums, and lectures to the workmen, foremen, and masters of shops and factories are held at certain times, which are well attended. Naturally each industrial technical school has, if not an extensive museum, certainly the nucleus of such an institution, just as a school has its own library.

CHAPTER X.

TRADE AND TECHNICAL EDUCATION IN ITALY.

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INTRODUCTION.

As early as the fifteenth and sixteenth centuries several efforts were made in the direction of industrial education in Italy, but these were tentative and of little importance in the midst of the general neglect of public education, and especially of practical instruction. Even in the eighteenth century the celebrated Giovanni Battista Vico, in his book "De nostri temporis ratione studiorum," complained that in Italian schools no attention was given to "the practical utility of the studies." At the close of the eighteenth century the Grand Duke Pier Leopoldo established at Florence a drawing school for artisans, Giuseppe Bonaparte established at Naples and at Nola schools of arts and trades, and during the first half of the nineteenth century several schools for workingmen were established, which marked the commencement of the union of the school and the workshop.[b] In 1841–42 and in 1842–43 the Austrian Government, which then held the provinces of Lombardy and Venetia, established at the cities of Venice and Milan two technical schools having a real industrial character. These schools had for their object not only commercial and artistic instruction, but also instruction in chemistry and in science applied to the arts and trades (dyeing, glass making, tanning, wine making, manufacture of pottery, etc.). These two schools, however, soon lost their industrial character, and were transformed into schools for general culture.

The so-called technical schools, instituted by the law of November 13, 1859, followed the same tendency, and became schools of general culture. Of these there are at present about 280, distributed throughout the peninsula.

It was only after the formation of the national union that real industrial education was established in Italy. The needs of the time caused the establishment of industrial schools and schools of arts and trades, in addition to the schools for literary, scientific, and general culture.

[a] This chapter was prepared for this report by Dr. Riccardo Bachi, formerly of the Instituto Tecnico di Vicenza, now chief secretary of the Italian Royal Industrial Museum, Turin, Italy.

[b] Gli istituti tecnici e le scuole tecniche, by Bardelli e Moreschi. Report to the Minister of Public Education, Rome, 1900.

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These schools were founded chiefly by local action. Sometimes they were founded and maintained, especially in northern Italy, by workingmen's associations. Usually they received subsidies from the State, from the provincial and communal administrations, from the chambers of commerce, and sometimes even from the savings banks. There are also some schools having a capital fund, and schools founded by charitable institutions.

These schools have grown, here and there, according to their necessities and the means of the localities, without a preestablished plan, almost without the intervention of the State. They are of widely different types, and vary greatly in their objects and programmes. There is an almost absolute lack of coordination, but the schools respond readily to the needs of each locality. The tendency toward administrative regulation which has become so strong among the Latin nations, and on account of which their institutions have acquired such perfect symmetry, has not succeeded in bringing the Italian trade schools to a uniform system. While the other schools—elementary and secondary—have an almost identical programme and character throughout the entire kingdom, the industrial and trade schools have a liberty of action that permits adjustment to surrounding conditions.

It is desirable, however, that a law should be passed, which would bring about a closer relation between the schools, make State supervision more effective and the condition of the teaching personnel more certain, without encroaching upon the liberty of their organization and of their programme. On two occasions, July 12, 1880, and June 27, 1884, the Chamber of Deputies invited the ministry of agriculture, industry, and commerce to present a bill for the regulation of these schools. Such bills have been presented before the Parliament several times—in 1886, in November, 1889, and in November, 1893—but the conditions of parliamentary work did not permit their passage. A desire for such a law was recently expressed at the first congress of Italian industrial and commercial schools held at Turin in September, 1898.

The schools are of two distinct types, industrial schools and schools of art applied to industry. There are, of course, several grades representing each of these types.

At the head of the industrial schools are institutions having the rank of universities. These schools are intended to train the captains of industry, industrial engineers, and superintendents of industrial enterprises. There are in Italy three large schools of this grade, the Italian Royal Industrial Museum, at Turin, the Politecnico, at Milan, and the School for Engineers, at Naples. These institutions are of great importance, but do not come within the scope of this inquiry. Next, there are the industrial and trade schools of medium grade intended to train foremen of workshops; and, lastly, the schools of

arts and trades (schools of inferior grade) for training workmen. In the former type are found several superior schools of art applied to industry (a higher grade of schools) and the schools of art and design applied to industry, for workmen in artistic industries.

There are no complete statistics of these schools. The ministry of agriculture, industry, and commerce, in a recent publication,[a] produced statistics relating to schools receiving subsidies from that ministry, but these figures do not give a complete idea of industrial education in Italy, because there are a number which do not receive any subsidy. According to this publication, there are 68 industrial schools and schools of arts and trades (schools for foremen of workshops and for workmen) subsidized by the ministry, with a total attendance, in 1898–99, of 16,551 students, of whom 9,069 presented themselves for examination; 6,690 were promoted to higher classes, and 586 were graduated. These schools receive a subsidy of 259,710 lire ($50,124) from the ministry of agriculture, industry, and commerce, 24,555 lire ($4,739) from the ministry of education, 156,258 lire ($30,158) from the provincial administrations, 251,857 lire ($48,608) from municipalities, 125,180 lire ($24,160) from the chambers of commerce, 5,905 lire ($1,140) from labor organizations, 28,630 lire ($5,526) from savings and other banks, monts-de-piété, etc., and, finally, a yearly income of 106,048 lire ($20,467) from legacies and various donations. The total, 958,143 lire ($184,922) is not, however, the entire amount of the budget, because it does not include the tuition fees which several of the schools require, nor the returns from the sale of objects made in the workshops, etc.

The superior schools of art applied to industry are 8 in number, with an attendance of 984 students in 1898–99. They receive 72,000 lire ($13,896) from the ministry of agriculture, industry, and commerce, 15,000 lire ($2,895) from the minister of education, 46,500 lire ($8,975) from the provinces, 49,100 lire ($9,476) from the communes, 11,140 lire ($2,150) from the chambers of commerce, 2,952 lire ($570) from various administrations, and 3,405 lire ($657) from legacies and special funds. The schools of art applied to industrial design number 117, with an attendance of 11,259 pupils in 1898–99. They receive 75,990 lire ($14,666) from the ministry of agriculture, industry, and commerce, 1,520 lire ($293) from the ministry of education, 36,160 lire ($6,979) from the provinces, 111,947 lire ($21,606) from the municipalities, 28,010 lire ($5,406) from the chambers of commerce, 12,002 lire ($2,316) from labor organizations, 11,213 lire ($2,164) from savings and other banks, etc., and 29,920 lire ($5,775) from legacies and special funds.

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[a] Annuario per l'anno 1901 delle scuole industriali, professionali, commerciali, di disegno industriale e d' arte applicata all' industria dipendenti o sussidiate dal Ministero d'Agricoltura, Industria e Commercio. Rome, 1901.

These schools are of course unevenly distributed in the different sections of Italy. For industrial schools and schools of arts and trades, Piedmont and Lombardy, essentially industrial districts, take the lead with 13 and 10 schools respectively; Campania and Tuscany come next with 10 and 8 schools respectively; then come Venetia with 5 schools, Emilia with 4, Liguria and Sicily with 3 each, Calabria with 2, and lastly, Apulia, Basilicata, and Sardinia with only 1 school each. The superior schools of art applied to industry are situated in Tuscany at Florence, in Lombardy at Milan, in Campania at Naples, in Sicily at Palermo, in Campagna di Roma at Rome, and in Venetia at Venice. As regards schools of art applied to industry and schools of industrial design, Lombardy and Venetia are in the lead with 35 and 25 schools respectively, then come Tuscany with 10 schools, Piedmont and Sicily with 9 each, Marches with 8, Emilia with 7, Campania with 5, Abruzzi with 3, Apulia with 2, and Liguria, Campagna di Roma, Basilicata, and Calabria with 1 school each. Umbria and Sardinia have no schools of this class. But these figures have only a relative value, because, as stated, there are several important schools, especially schools of applied art, which receive no subsidy from this ministry.

Thus there are at present in Italy about 200 industrial and industrial-art schools that receive subsidies from the ministry of agriculture, industry, and commerce, and are, therefore, under its authority. It would be well if all the schools of this kind were under the supervision of this ministry, and it had the right of inspection of those that receive no subsidy. There is, on the other hand, a certain number of schools which, while they have a real industrial character, are under the control of the ministry of public education. Among others may be cited the *Politecnico* at Milan, which trains industrial engineers; the *scuole di applicazione per gli ingegneri*, which train civil and industrial engineers; the industrial departments annexed to some of the *Istituti tecnici*, which give a medium grade of industrial instruction, and several special schools, such as the *Scuola di tessitura di Como*, a weaving school; the *Scuola industriale di Bassano*, an industrial school; the *Scuola delle pietre dure di Firenze*, a school for carving in hard stone, etc. On the other hand, the ministry of agriculture, industry, and commerce has jurisdiction over superior naval instruction at the *Regia scuola superiore navale di Genova*, and the ministry of public education directs the intermediate naval instruction by means of the *Istituti nautici*, which trains the captains of vessels and marine machinists. These schools should logically come under the authority of the ministry of marine.

It would seem to be opportune, therefore, that a law should be passed distributing these different groups of schools in a more logical manner among these three ministries in such a way that each would

have charge of that group of schools which it is most capable of directing. It has several times been proposed that all the industrial schools, schools of arts and trades, and of art applied to industry be placed under the ministry of education; but it is to be feared that such a change would not be advantageous to the schools. The ministry of agriculture, industry, and commerce is brought into closer contact with the real needs of the industry and commerce of the nation, and is, therefore, more capable of making the schools practical or of preserving their practical character.

It is believed that beneficial results would follow a complete revision of the subsidies granted, so that they would better respond, not only to the merit of the schools, but also to the local conditions.[a] The subsidies could be administered according to the practice which has long been followed in England in the elementary schools—that is, to give subsidies in proportion to the results obtained by the schools as certified by inspectors. However, account must also be taken of local conditions, so as to grant the subsidies where the schools can be of the greatest utility to the local industries, and also where the financial resources of the local administrations are small. The subsidies accorded by these local administrations could also be organized in a more reasonable way, and might perhaps be rendered obligatory under certain conditions. When there is an industrial school the existence of which is a benefit, first to the nation at large, then more particularly to the inhabitants of the province, and, above all, to the citizens of the commune, the merchants, manufacturers, and workmen of the locality, it would perhaps be just to make obligatory a subsidy by the State, the provincial administration, the municipalities, the chambers of commerce, and the labor organizations.

The ministry of agriculture, industry, and commerce exercises complete supervision over these schools, but the means at its disposal are insufficient. It not only inspects the schools, but the programmes and the nomination of teachers are sometimes submitted for its approval. The schools annually send in statistical and economic reports, a general resumé of which is published by the ministry.

In the exercise of the supervision of the schools of art applied to industry, the ministry is aided by the *commissione centrale per l'insegnamento artistico applicato alle industrie*, a central commission created by the royal decrees of October 23, 1884, and of May 21, 1885. This important commission is charged with the following duties: (1) To exercise a supervision over the industrial art museums, the schools of art applied to industry, the drawing schools for workmen, and all other institutions under the authority of or subsidized by the ministry of agriculture, industry, and commerce, and having for their object

[a] Il Ministero di Agricoltura, Industria e Commercio nelle sue scuole e nell'economia nazionale, by Primo Levi. Rome, 1898.

the artistic education of the working classes; (2) to give advice regarding propositions for the establishment of new museums or schools of industrial art or for the extension of existing museums and schools; (3) to examine the programmes of schools in order to insure that they respond to the needs of industrial art instruction in the localities where the schools are situated or are to be created; (4) to give advice regarding the selection of teachers; (5) to exercise a supervision over the methods of instruction of the schools of art applied to industry, of design, modeling, etc.; (6) to provide for making and distributing among the schools collections of plaster models according to the different types of Italian ornamentation, and special collections for the application of ornamentation to all branches of industrial art; (7) to give advice regarding the books and publications which should be distributed among the schools; (8) to decide upon the merits of persons aspiring to obtain the title of teachers for the instruction of art applied to industry.

This commission serves a very useful purpose, and it would be well to establish a similar commission for the professional and industrial schools. A part of the members of these commissions might be elected by the schools.

The inspection service of these schools is insufficient on account of the lack of an inspecting personnel, there being no special provision for this purpose. The work is intrusted, first of all, to the factory inspectors (*ispettori delle industrie*) who hold office by virtue of the royal decree of April 3, 1879, and who must exercise an inspection not only over the professional instruction, but also over the entire national industrial operations. The mining engineers (*ingegneri delle miniere*), officers who are under the jurisdiction of the ministry of agriculture, industry, and commerce, and exercise a supervision over the mines, are also charged with this duty. Finally, for the schools of industrial art, the members of the *commissione centrale per l'insegnamento artistico industriale*, mentioned above, are charged with the duty of inspection. But all these officers exercise supervision over the schools only as a supplementary duty, and the number is not sufficient for the undertaking, so that there are schools that are not inspected except at long intervals, sometimes not for several years. Aside from these functionaries, the ministry sometimes commissions some person living in the locality of a school to inspect the same; but frequently these inspections do not present a sufficient guaranty of independence or ability on the part of the inspectors. It is evidently desirable to establish a special corps of inspectors for the industrial schools.

As has been already observed, the origin of the different schools having been entirely spontaneous and without governmental intervention, they present a variety among themselves, which no doubt has its advantages, but it also has its disadvantages. Sometimes in the same or in neighboring localities there are schools of a similar or identical

character, and valuable energy is wasted in useless competition. The ministry of agriculture, industry, and commerce should have the power to bring about the fusion of such schools. These schools should also be systematized in a general way, so that they might better respond to the object of improving the national industry, leaving to each its proper character or its special aims and allowing each to adapt itself to the needs of the locality where it exists. They should not, of course, all be forced into the same mold, nor should a uniform programme be made and rendered obligatory for all; neither should a fixed curriculum of studies be established among schools of different grades. But at the same time a certain coordination might be arrived at by instituting regular congresses and organizing a correlation among the schools for the exchange of didactic material, information regarding programmes, etc. Such work of coordination might become one of the principal duties of the ministry of agriculture, industry, and commerce.

One of the most efficacious means of obtaining coordination among the schools is better regulation of the recruiting of teachers. If all the teachers of industrial schools were educated in the same superior school they would, upon leaving the school, be in accord with regard to the method of instruction without prejudice to the variety of character and organization of the schools. An attempt has been made in Italy to obtain this result by instituting in the Italian Royal Industrial Museum at Turin a series of classes having a truly normal character, which lead to the title of teacher of industrial schools and schools of arts and trades, for the teaching of physics and industrial chemistry, mechanical technology, and of ornamental design. Unfortunately, conditions have changed gradually, so that while the Royal Industrial Museum still retains the power of bestowing these titles, in practice they are but little appreciated, and teachers are chosen without regard to uniformity of methods and are not always taken from the list of graduates of the Royal Museum.[a]

Notwithstanding their defects, the industrial, trade, and applied art schools exercise a beneficent influence upon the social life of the nation. Italy is afflicted with a scourge which sadly prevails in the Latin nations and which is almost unknown in America, namely, the intellectual proletariat. In Italy, for the last thirty years, there has been an excess of young persons who devoted themselves to study, and especially to classical study, a phenomenon which had its origin partly in the special qualities of the race, and partly in various social circumstances of the epoch. It follows that there is a superabundance of doctors, professors, lawyers, etc., who can not find work in the professions for which they have been educated, and who devote themselves particularly to seeking public employment. Whenever there

[a] See article on *Le Scuole industriali in Italia* in Rivista Tecnica, January, 1901.

are vacancies in the civil service, there is a host of competitors, even when the places offer the most niggardly salaries. This unfortunate class of proletarians weighs heavily upon the social balance of the nation, because it is a truly unproductive class. If, on the contrary, the industrial and trade schools be developed and raised in the public esteem, they will become useful to the nation, not alone on account of the progress that they will bring about in the industries, and in making more skilled workers and foremen, but also because they may divert from classical studies and toward more useful occupations a class of young people who are crowding the ranks of the intellectual proletariat.

INDUSTRIAL SCHOOLS AND SCHOOLS OF ARTS AND TRADES.

Putting aside the schools for higher technical instruction, industrial schools and schools of arts and trades will first be considered. In the preceding pages some statistics of these schools have been given, and a distinction has been made between schools for the training of foremen of workshops and those for workingmen.

The schools of the former class are less numerous and it is natural that they should be so. As they must be provided with considerable scientific material—must have workshops and a well-paid teaching force—they can not be very numerous. "If, for example," observes Prof. Tullio Buzzi, the director of the school of weaving and dyeing at Prato, "there were in Italy ten localities where weaving and textile printing had attained a considerable development it would not on that account be necessary to create a special industrial school in each locality. It would be sufficient to have one or two schools to furnish the necessary personnel to the factories of all the ten localities."

These schools, as will be better seen in the reports which appear in the following pages of each of the most important schools, generally have for their object instruction in a single industry or in a small number of related industries. This specialization is very useful and should be made even closer. The instruction is, in general, almost exclusively technical, and little room is left for branches of general education, because pupils are usually not admitted unless they have followed courses of general education in the secondary schools, or until they have passed an examination in such studies.

These schools, as well as those for workingmen, generally have workshops for practical instruction. These workshops are sometimes exclusively devoted to the instruction of the pupils, where they prepare the apparatus, models, and didactic material for their own schools—objects, in short, which are destined for the school and not for the public. Other schools have workshops where the pupils execute work to order, or which is intended for public sale, so that the

school possesses an industrial establishment from which it receives some revenue. This revenue is not generally of great financial importance to the school. Sometimes it is partly drawn by the teachers as a supplement to their salaries. The selling prices of the products of these workshops are necessarily below the current market prices, as they are made by pupils who are still, one may say, in the period of apprenticeship, and the labor cost can not be fully considered in the cost of production. However, as the traffic in such products is not of any great importance, it does not constitute a dangerous competition with private establishments and does not excite the enmity that prison labor does everywhere. Some of the schools have no workshops of their own and send their pupils, under special arrangements, to private workshops; others make special contracts with private manufacturers, who, in a way, conduct their enterprises in the school building and employ the pupils as workingmen. Each of these different types of workshops presents advantages and disadvantages, varying according to the character of the schools. It can not be said that any one is preferable in all respects to the others.

Notwithstanding the special technical character of these schools for foremen, and in spite of the development of the workshops annexed to the schools, the complaint is generally made that the schools do not teach the true practice of the industry. This is perhaps a general defect of all such schools and is not confined to Italian industrial schools. A remedy for this defect may be found in the creation of scholarships for practical industrial education which the ministry of agriculture, industry, and commerce is about to establish. These scholarships are intended for the best pupils of industrial schools and will permit them to acquire practical knowledge in manufacturing establishments in Italy or abroad.

THE INDUSTRIAL SCHOOL "ALESSANDRO ROSSI," VICENZA.

This school was founded in 1878 by Senator Alessandro Rossi, who made a donation of 350,000 lire ($67,550) for the expenses of establishment and for one-half the running expenses for the first six years. Senator Rossi desired to found a large school for mechanical industries, following the example of the four large French national schools at Châlons-sur-Marne, Aix, Angers, and Lisle, and he actually succeeded in having erected a school of considerable importance for the mechanical industries. The school is located in a city of about 35,000 inhabitants which is not a great industrial or commercial city, but which is surrounded by smaller districts containing important industrial establishments. It is not merely a local school, but rather a national institution, being attended by pupils from all the provinces of Italy. The purpose of the school is to prepare intelligent and skillful foremen for the mechanical industries, and to qualify for advanced

technical pursuits such of its pupils as are specially qualified for the study of higher mechanical technology. It is therefore divided into two sections, a section for mechanical construction work, electro-technics, and the textile industries, the object of which is to train foremen for the electrical, mechanical, weaving, and spinning industries, and a section for higher studies, which prepares the best students for the superior schools for engineers.

The course comprises two preparatory and three normal years. During the first four years are taught subjects of general education and technical branches common to the two sections. The real division takes place in the last year, when those in the first section are taught the resistance of materials, mechanical technology, power machines, electro-technics and textile technology, and in the second section students receive instruction in complementary mathematics, history, geography, and the Italian language.

All pupils serve an apprenticeship in the six workshops attached to the school, and remain longest in those where they show the greatest aptitude. These workshops are for patternmakers and carpenters, molders, blacksmiths, machinists (*congegnatori*), turners and machine tenders, and electricians. The shops are very well provided with materials, models, tools, and machinery. A part of the material is manufactured in the workshops by the pupils. Orders are also taken from private establishments, and a considerable business is done by furnishing castings and other products made by machines or with tools, from which source the school receives considerable revenue. The expense of maintaining these workshops is about 12,000 lire ($2,316) per year, but the revenue derived from the sale of products reduces the net expense to about 3,000 lire ($579). The institution is a boarding school, no day pupils being admitted. The regular tuition is 700 lire ($135) per year, but for the pupils from the province of Vicenza it is only 600 lire ($116) per year. There are, however, several scholarships and partial scholarships. The discipline during meal hours, recreation, promenades, etc., is intrusted to the teachers of the school and not to special officers. By this arrangement there is a complete personal contact between the teachers and the pupils.

The income of the school is quite large. It receives 35,000 lire ($6,755) from the Government, 29,000 lire ($5,597) from the provincial administration of Vicenza, and 3,000 lire ($579) from the commune of Vicenza. It also obtains a considerable revenue from the tuition fees. The commune of Vicenza also grants the free use of the building in which the school is located. There is an average attendance of 150 pupils per year, and the graduates are employed in all the Italian industries. The school is in constant receipt of requests from industrial establishments, so that there is no difficulty in finding positions for the pupils who are graduated each year. The period of

apprenticeship is generally two years at the most, and there are those who, from five to eight years afterwards, receive annual salaries as high as 6,000 lire ($1,158). Some of them have positions abroad and have salaries of 12,000 lire ($2,316) per year. The school thus shows good results, but in view of the great development of local industries it would perhaps be desirable to give greater attention to instruction in spinning, weaving, and electro-technics.

INSTITUTE OF ARTS AND TRADES OF MARCHES, FERMO.

This institute was founded at Fermo, in central Italy, in 1861, with the revenue derived from the Montani charitable fund, under the name of *Istituto d'arti e mestieri per le Marche*. It was quite recently transformed, as a result of an extraordinary inspection, by a royal decree of May 16, 1901. This institution is supported by the revenue from the Montani and Perpenti funds, and receives in addition an annual contribution of 16,000 lire ($3,088) from the ministry of agriculture, industry, and commerce, 10,000 lire ($1,930) from the administration of the "*fondo per il culto*", 17,500 lire ($3,378) from the provincial administration of *Ascoli Piceno*, and 7,000 lire ($1,351) from the commune of Fermo.

The object of the institute is to give theoretical and practical instruction in mechanics and electro-technics, for the purpose of training pupils for machinists and foremen of workshops in mechanical and industrial establishments. The instruction is divided into two courses—the preparatory course of two years and the normal course of three years.

The institute is a boarding school like the school at Vicenza, but day pupils are also received.

The branches of study are Italian, German, French, history, geography, arithmetic, algebra, drawing, physics, chemistry, technology, geometry, mechanics and its applications to industry, and electro-technics. Attached to the institute are shops for ironwork, woodwork, machine construction, modeling, wood carving, etc., where work is done on private orders, which yields a considerable revenue. There is an average attendance of 70 pupils.

TRADE SCHOOL, BIELLA.

This school (*Scuola professionale di Biella*) is the first established in Italy, having been founded in 1869 by Quintino Sella, the celebrated minister and savant, in a district rich in industrial establishments and in a city spoken of as the Manchester of Italy. Its object is to train technical overseers and foremen for the mechanical arts, chemistry, textiles, dyeing, construction work, and wood carving.

The school has several courses, namely, one normal day course of three years, several evening courses, and theoretical and practical courses in steam-boiler tending and in electricity.

The subjects taught are Italian, arithmetic, algebra, geometry, trigonometry, bookkeeping, calligraphy, ornamental and geometrical drawing, architectural design, topography, machine technology, plastic art, wood carving, physics, statics, practical and descriptive geometry, construction work, kinematics, mechanics, physical, mechanical and textile technology, weaving, general and applied chemistry, and dyeing. In the two theoretical and practical courses special instruction is given for enginemen and electricians. During the year 1898–99, there were 138 pupils taking the day courses, 111 the evening courses, and 8 the theoretical and practical courses; during the year 1899–1900 the pupils for day courses were 142 and for evening courses 145.

The school has considerable resources, receiving annual contributions of 12,000 lire ($2,316) from the ministry of agriculture, industry, and commerce; 5,650 lire ($1,090) from the provincial administration of Novara; 5,000 lire ($965) from the commune of Biella, in addition to the use of the building, the annual rental value of which is 5,000 lire ($965); 5,000 lire ($965) from the chamber of commerce of Turin, and 4,320 lire ($834) from several other sources.

The school possesses laboratories of chemistry, weaving, and technology, in the first of which analyses are sometimes made for private parties. To the school is annexed the municipal public library.

From the foundation up to the year 1899–1900 the number of graduates from day courses was 293, and of these 138 (47 per cent) were graduates in construction work, 75 (26 per cent) in mechanics, and 80 (27 per cent) in weaving and dyeing. Many of these graduates are employed in mechanical workshops, wool and cotton factories, etc., in Italy and in foreign countries.

INDUSTRIAL SCHOOL OF ALESSANDRO VOLTA, NAPLES.

This school (*Scuola industriale Alessandro Volta*) was founded by a royal decree of January 28, 1886. According to article 2 of this decree, its object is to train skilled workmen and foremen for mechanical, chemical, and textile industries by means of theoretical and practical instruction in physics, chemistry, and mechanics, and to advance the development of production in the city of Naples, either by perfecting the methods of existing industries or by stimulating new lines of industrial work. In 1890 instruction in the applications of electricity was substituted for that in textiles.

The school is divided into four sections, as follows: For machinists, molders, chemists, and electricians. The normal course covers three years, but there is also a preparatory course of one year for such as do not have a sufficient general education. The studies are Italian, French, history, geography, calligraphy, arithmetic, algebra, bookkeeping, plane and solid geometry, trigonometry, general and applied physics, general, analytical, and applied chemistry, kinematics,

mechanical technology, ornamental, geometrical, and mechanical drawing, plastic art, and laboratory and shop work. There are attached to the school an electrical workshop and a machine shop with a foundry. In 1898–99 the number of pupils was 338, but only 240 appeared for examination, and of these 138 were promoted and 14 received their graduating diplomas.

For pupils who aspire to become foremen of workshops, a supplementary course of one year has been established for practical apprenticeship.

The laboratories and workshops give excellent results. A considerable part of the scientific material is prepared by the pupils themselves. The machine shop and foundry were established in 1897, and the pupils have made the operating machinery and the necessary appliances, including the motor for working the ventilator of the furnace and the transmitters requisite for its operation. The section of chemistry, by default of means, has not given as good results as the other sections.

The school receives an annual contribution of 21,000 lire ($4,053) from the ministry of agriculture, industry, and commerce, 6,000 lire ($1,158) from the province of Naples, and 27,000 lire ($5,211) from the commune of Naples.

ROYAL TRADE SCHOOL OF WEAVING AND DYEING, PRATO.

This school of weaving and dyeing (*Regia scuola professionale di tessitura e tintoria*) at Prato, in Tuscany, was founded in 1886. Its object is to train technical overseers and workers in the weaving and dyeing industries. At first a preparatory course in arithmetic, geometry, bookkeeping, and Italian was taught, but as this caused a useless expense it was abolished in order that all efforts might be concentrated upon the technical course, a decision which perhaps merits imitation by the other Italian industrial schools.

The existing courses of the school are as follows: Two ordinary day courses, one for instruction in chemistry and dyeing and the other for weaving and spinning; one evening course in drawing; a Sunday course, divided into two sections, one for dyeing and the other for spinning and weaving.

The evening course had, in 1898–99, 42 pupils and the Sunday course 32. These are the courses intended for workers, and the pupils are recruited from among the employees of industrial establishments of the vicinity. These employees ordinarily attend the school several successive years. They find a better reception in the local establishments, are better paid, and "it may be said," writes Prof. Tullio Buzzi, director of the school, "that the overseers of the self-acting spinning machines and the overseers in dyeing establishments of the vicinity are workmen who have attended the school." The course in

spinning has enabled manufacturers of Prato who have introduced the self-acting machines to instruct their force in this work without resorting to foreign labor. The course in drawing has placed the weavers in a position better to adapt their designs to the technical exigencies in the manufacture of woven goods.

It is in contemplation to add to the foregoing evening courses other courses in mechanics, mechanical drawing, plastic art, etc., so as to establish a veritable school of arts and trades for perfecting workingmen employed as machinists, masons, cabinetmakers, wood-carvers, etc. Special courses in electro-technics and in steam-boiler tending will also be added during the years when there is a sufficient attendance.

The day course is of great importance. A division into two sections, made in 1896–97, brought about a specialization which was of advantage to the pupils of both sections. The section of chemistry and dyeing comprises a course in general inorganic chemistry; a course in general organic chemistry sufficiently extended to cover the study of coloring materials; a course in textile fibers (bleaching, dyeing, and finishing); a course in analytical chemistry for analyses relating to products employed in dyeing, printing, and finishing textile fibers, woven goods, etc.; a course in chemistry applied to the printing of textile fibers, and practical work in the use of printing machines; a course in drawing which serves as a complement to the course in dyeing and printing, and a course in physics and mechanics. The section of spinning and weaving comprises a course in textile fibers, wool spinning, and the formation of tissues; a course in cotton, linen, hemp, jute, and silk spinning and weaving machinery; a course in ornamental and mechanical drawing and designing applied to the weaving industry, and a course in physics and mechanics. In 1901–02 it is intended to add a course in analytical chemistry, with a special laboratory for the analyses of all products relating to the textile fiber industry, for training specialists, a course in kinematics, and a course in weaving design for the training of technical designers for the weaving and cloth-printing industries. All these courses, aside from the theoretical instruction, thoroughly develop the practical side by means of the well-equipped laboratories and workshops which the school possesses. The pupils can there manufacture tissues of various kinds and can make collections of samples, which on completion of their studies can be used to demonstrate the skill that they have acquired. Analyses are also made for the commune of Prato and for private parties.

The number of pupils in the day courses is steadily increasing. In 1898–99 it was 38 and in 1899–1900 it was 50, of which 41 were in the section of chemistry and dyeing and 9 in the section of weaving. In 1900–01 there were 52 pupils, of whom 40 were in the section of

chemistry and 12 in that of weaving. The graduates of these two sections are very much sought after by manufacturers, by whom they are given positions without serving an apprenticeship. The director of the school writes that after a practical experience of one or two years the graduates of the section of chemistry and dyeing are promoted to positions as overseers or superintendents of dyeing establishments, in which they receive good salaries. After four or five years they each receive, on an average, 300 to 400 lire ($57.90 to $77.20) and sometimes as high as 600 lire ($116) per month. They are employed in the manufacture of woolen cloth, cotton goods, hats, coloring matter, and in establishments for dyeing, printing, weaving, etc. As the school is situated in a region where the straw-plaiting industry is strongly developed, the ministry of agriculture, industry, and commerce, in 1897, sent Prof. Tullio Buzzi to France, England, Germany, and Switzerland to make an inquiry into this industry. The school then carefully studied the industry and sent the report and samples of work to the chamber of commerce at Florence. In consequence, manufacturers often apply to the school for information and advice regarding the bleaching and dyeing of straw.

This school is, without doubt, one of the best in Italy, and can well compete with those in foreign countries. It enjoys such a good reputation that pupils go there from all parts of Italy. The results would perhaps be still better if the resources were greater. The annual contributions are only 25,600 lire ($4,941), and it should be mentioned that of this sum 1,000 lire ($193) are annually contributed by Mr. Eugenio Bona, proprietor of a large cloth manufacturing establishment at Carignano, in Piedmont, who, in addition to this contribution to the school at Prato, also gives 3,000 lire ($579) per year to the industrial school at Biella.

INDUSTRIAL SCHOOL ANNEXED TO THE ROYAL TECHNICAL INSTITUTE OF VICTOR EMANUEL II, BERGAMO.

The technical institutes are advanced schools of a secondary grade which give a general, not classical, education to young persons from 14 to 18 years of age and a specialized scientific education preparatory to scientific university studies, and also train persons as land surveyors and accountants. These institutes, which number about 70, are under the jurisdiction of the ministry of public education. Several of them, those of Bergamo, Como, Livorno, Naples, Rome, Terni, Turin, and Venice, have established an industrial section for the training of foremen of workshops. The one attached to the technical institute of Bergamo (*Scuola industriale annessa al regio istituto tecnico Vittorio Emanuele II*) is perhaps the most important. This section was founded in 1885. It receives an annual contribution of 15,000 lire ($2,895) from the ministry of public education, 800 lire ($154) from the ministry of agriculture, 5,200 lire ($1,004) from the province of Bergamo, 7,000

lire ($1,351) from the commune, 8,000 lire ($1,544) from the chamber of commerce, 2,500 lire ($483) from the industrial society of Bergamo, and a subsidy of about 5,500 lire ($1,062) annually from commercial and manufacturing establishments.

This section is divided into three subsections of three years each, devoted respectively to mechanics, weaving, and chemistry. Steps are being taken to add also subsections for spinning and electro-technics, in order to provide fully for the needs of the numerous industries of the locality. The instruction comprises, in addition to matters of general education, mechanical drawing, mechanics, descriptive geometry, general and technological chemistry, general and applied physics, weaving, textile drawing, industrial accounting, and mechanical technology.

There are attached to the school mechanical and weaving shops and a chemical laboratory to which is annexed the municipal chemical laboratory. The number of pupils of this section has continually increased. In 1885–86 it was only 5, the next year 25, and in 1898–99 it was 43. The graduates easily find good positions.

To the industrial section have been added other schools which are of an inferior rank, but of considerable importance, so that the technical institute at Bergamo has become a center of elementary and intermediate industrial education. It has, first of all, the school for foremen in textile and mechanical industries (*Scuola per altieri capi operai per le industrie tessili e meccaniche*), a school intended for young men who aspire to become foremen and overseers in these industries. The day course is divided into two sections (textile and mechanical industries) and trains persons for intermediate positions between those of workmen and of technical directors. In 1898–99 there were 37 pupils, of whom 18 took the mechanical and 19 the textile course. There are also Sunday schools (*scuole domenicali*) for workingmen, which in 1898–99 had an attendance of 242 pupils. They comprise a course in weaving (81 pupils), a course in electro-technics (66 pupils), a course for boiler tenders (38 pupils), a course in machine drawing (37 pupils), and a course in mechanics (20 pupils). These courses cover a period of two or three years, and are patronized by employees of industrial establishments. There are also the evening schools for workers and artisans (*scuole serali per operai ed artieri*), which in 1898–99 had an attendance of 271 pupils. They comprise a preparatory course of two years, followed by special courses in drawing applied to the arts, decorative painting and plastic art, and in drawing for the machinists', blacksmiths', masons', and carpenters' trades. The technical institute of Bergamo has succeeded in solving the problem of uniting in a single organization intermediate industrial instruction with elementary and popular courses, accomplishing much better results and with a smaller economic effort than is accomplished when these institutions are separate.

ROYAL TRADE SCHOOL "LORENZO COBIANCHI," INTRA.

To the schools for the training of technical chiefs may be added that founded in 1886 by the donation of Lorenzo Cobianchi (*Regia scuola professionale "Lorenzo Cobianchi"*), in the small industrial town of Intra. This school has an annual expense fund of about 20,000 lire ($3,860), and comprises a day and a night course. The day course covers three preparatory years and three years for normal trade work. The normal course is divided into the three sections of mechanics, chemistry, and electro-technics. The evening course formerly comprised a course in drawing, one for boiler tenders, and one in weaving, but the course in weaving was discontinued in 1900, it being the intention to establish a well-developed day course in that industry. The number of pupils in 1899–1900 was 83 in the preparatory course, 4 in the course in mechanics, 12 in chemistry, 6 in electro-technics, 136 in the course in drawing, and 34 in that in boiler tending. The school has laboratories of industrial chemistry, dyeing, and electro-technics.

The section for electro-technics, established in 1899, responds to a great need, because this region is rich in water power, and several enterprises have been founded for the transmission of electricity. The first course of this section is common with that of mechanics. In the second are taught electrology and the drawing of electrical machines and appliances; in the third, electro-technics, practice in electric measurements, design and construction of electrical machinery and installation of industrial electrical apparatus. This section will probably give good results in the future.

The pupils of the school at Intra easily find positions as technical chiefs, even in foreign countries.

SCHOOLS OF MINING.

To the schools treated in this chapter may also be added the mining schools intended for the education of a technical personnel skilled in the exploitation of mines. In Italy there are no superior schools of mines, such as are to be found in other countries for the education of mining engineers. There are, however, schools of an intermediate degree intended for the education of persons for secondary positions in the mining industries, and this object has been attained.

An official publication (a) says in regard to these schools: "At present many of the graduates, who are mine bosses in the large mines or superintendents in the smaller ones or assistants in the royal corps of mines, are rendering valuable services to the mining industry by

a Notizie e documenti sulle scuole minerarie del Regno. Annali di Agricoltura. Rome, 1885, p. viii. See also the Annali di Agricoltura for 1887 and for 1896.

substituting in the place of the empirical methods of exploitation the methods suggested by science and conforming to modern mining rules."

Until the year 1885 the graduates of these schools received the title of mine bosses (*capi minatori*), but as the graduates of these schools, especially in Sicily, are placed in higher positions, such as actual directors of mining exploitations, and as these graduates are frequently called as experts by the judicial authorities in questions relating to mines and mining operations, a royal decree of December, 1885, accords the graduates of these schools the title of mine bosses and mining experts (*capi minatori e periti minerari*). The teaching personnel of these schools consists partly of the engineers of the Royal Corps of Mines. In this way teachers are secured at small expense; and being also charged with the supervision of mining operations, they are in a position to give practical instruction in conformity with the progress of the mining industry.

There have been four mining schools founded in Italy: (1) The school of Carrara, in Tuscany, near the celebrated marble quarries, founded in 1872 for the purpose of instructing pupils in quarrying and in cutting and finishing marble, in order to train technical chiefs for the marble industry; (2) the school of Agordo, established in 1867, upon the initiative of Mr. Quintino Sella, the celebrated minister and savant, in northern Venetia, a region rich in mineral deposits; (3) the school of Caltanisetta, established in 1863, in Sicily, in the center of the sulphur mining operations, which is the most important mineral industry in Italy (this school was the first which was founded in Italy); (4) the school for mine bosses at Iglesias, in Sardinia, situated in an important mining center.

Only the last two exist to-day, and they have a real importance in the training of the secondary rank of employees in mining operations. Before the establishment of the school of Iglesias, the mining companies of Sardinia had to have recourse to foreign schools to obtain a good working force. There was a large number of "captains" who came from English schools and from the French school at Alais, whereas the body of laborers was entirely Italian. In 1869 a commission of inquiry proposed the establishment of the school of Iglesias with a docimastic laboratory intended especially for assaying galena for lead and silver, and also for assaying zinc ore. It is supported by contributions from the State, the province, the chamber of commerce of Cagliari, and the municipality of Iglesias. It is in the midst of the important metalliferous region of Sardinia, at a short distance from one of the most important mines in Italy. It has succeeded in furnishing a personnel to the mines which is a good substitute for the former foreigners, at a technical and economic advantage to the industry. The school does not admit pupils unless they have received a

secondary education of the first degree. The course of study covers three years, and comprises, besides several branches of general education, physics, mineralogy, geology, elementary and applied mechanics, analytical and docimastic chemistry, topography, the science of construction, the exploitation of mines, the mechanical preparation of minerals, metallurgy, etc. The school contains chemical, physical, and mineralogical laboratories. The chemical laboratory is also used for making analyses of minerals for private parties. The pupils work a certain number of days each year in the mines, so that when graduated they have not only a theoretical training, but they have a practical knowledge of the exploitation of a mine and can be employed as mine bosses under the direction of a mining engineer. The school had about 20 pupils. In 1897–98 there were 22, in 1898–99, 21, and in 1899–1900, 23. The graduates, the director states, are almost all well placed in the mines of the island, the others being employed abroad or in the royal corps of mines.

The school at Caltanisetta is organized almost on the same principles as the preceding, with special reference to the operation of sulphur mines.

In this school the course of instruction, aside from the branches of general education, is as follows: Drawing applied to machinery and mine-construction work; general, analytical, and applied chemistry; mineralogy; geology; mechanics; metallurgy; topography, and mining operations. In 1898–99 a course on the hygiene of mine workers, with instruction regarding first help to the injured in accidents during mine labor, was added, with good results. During the year 1900–01 the school had 27 pupils. Since its establishment there have been 198 graduates, and of these about 80 are employed as directors or assistant directors of mines, 14 are employed in the royal corps of mines, 8 are technical overseers in the sulphur mines, 5 are managers of mines, 8 are mine owners, etc.

The workingmen's schools are naturally much more numerous than those for the education of foremen and overseers. They are known by the name of schools of arts and trades (*scuole d'arti e mestieri*), but they may be subdivided into schools intended for training persons for a trade, offering a substitute for the long and tedious apprenticeship in industrial establishments, and schools for improving workmen already engaged in industries. The schools of the former class generally have day courses, while those of the second must naturally be limited to evening and Sunday courses. The former gradually approach the schools for foremen and overseers previously described.

The classification is not a clear one and, as in the case of classifications generally, has no absolute value. As regards the schools for the improvement of employees at work, they may approach the many evening and Sunday schools whose purpose it is to give elementary

instruction of a general character. These schools are very numerous, and some of them also give instruction of a trade character, but they are not industrial schools proper, and do not come within the scope of this inquiry.

The schools of arts and trades are numerous, both in the cities and in the small towns. Surprising results are accomplished in certain small country villages by these schools and the schools of arts applied to industries, which are entirely without means and scientific and didactic materials, the results being due to the early efforts of obscure and forgotten founders and the faithfulness of poorly paid teachers. These schools receive little or no subsidy from the State, and yet with a meager budget of a few hundred lire they sometimes succeed in exercising a remarkably beneficial influence. This vitality of certain rural industrial schools indicates that with better assistance they could probably attain a result of the highest social importance, such as has been reached in Scandinavia by the small schools of a similar character, that is, the revival of domestic industry. In certain sections of Italy, where for many reasons modern industry has not yet penetrated, the schools of arts and trades might become the center of flourishing domestic industries which would add considerably to the family incomes of the agricultural population and tend to diminish the temporary and permanent emigration.

In the pages following is given certain information regarding a number of art and trade schools of the two categories which come within the scope of this report.

ALDINI-VALERIANI INSTITUTE OF ARTS AND TRADES, BOLOGNA.

This institute (*Istituto Aldini-Valeriani per le arti ed i mestieri*) was established by means of a legacy by Professor Aldini, an eminent savant who, with a clear foresight into the needs of the future, had, since the year 1834, been wishing to found an institution for the diffusion of knowledge in mechanics, chemistry, and physics applied to the arts. The institution was definitely organized in 1876 and has for its object "the development of technical education and the training of the hand and eye of the young apprentice who wishes to become a skilled worker in the mechanical and physico-chemical arts, and to give popular courses in scientific, technical, and graphic instruction to the workers." The institute thus belongs to both of the foregoing classes of schools. It is divided into three sections: (1) A section for pupil apprentices of the mechanical arts, with day courses; (2) a section for pupil apprentices of physico-chemical arts, with day courses; (3) a section for adult workers, with evening courses.

The day courses cover three years and comprise instruction in Italian, physics, chemistry, mathematics, mechanical technology, geometrical, ornamental, and mechanical drawing, and political economy. The evening courses are as follows: One-year courses in geometrical

and ornamental drawing; three-year course in mechanical drawing; three-year course in masonry; one-year course for electrical workers; one-year course in steam-boiler tending. The pupils of the day sections, in 1898–99, numbered 145, and those of the night courses, 335. During the year mentioned the institute received a revenue of 48,941 lire ($9,446) from the Aldini-Valeriani fund, a contribution of 3,000 lire ($579) from the ministry of agriculture, industry, and commerce, and one of 9,940 lire ($1,918) from the municipality of Bologna.

Persons desiring admission to the school must show that they possess an elementary education. The pupils belong in general to the working class or to that of the small merchants. The graduates easily find positions as machinists, many being employed by the railroad companies.

The institute possesses a workshop well equipped for wood and metal work, in which the pupils learn carpentry, forging, turning, etc. Each pupil works on an average, according to his trade, 2,634 hours in the shops during the three-year course. In the workshop the pupils are trained, first of all, in the use of hand tools and in lathe work, and later on they take up machinery. The training is gradual for each trade, so that not until the middle of the second year of the course are the apprentices sufficiently instructed to be able to undertake real industrial work. The work sometimes consists of making tools or other objects needed in the laboratory or school, and sometimes they are made to order or for sale. The school does not take orders for objects unless their manufacture is of didactic utility to the pupils. In the execution of the work a degree of care and perfection is generally attained which makes it superior to ordinary work, because the purpose in view is the instruction of the pupils. A pamphlet published by the school in 1898 states that the prices of the objects made are usually the commercial prices, because it is not desired that the school should compete with private industrial establishments, and the latter therefore do not object to the workshop of the institute, and even send their patrons there for certain special work. The pupils are required to do all the manual work of the shop, such as repairing and cleaning the machinery, transporting the raw material and fuel, etc.

The evening courses most patronized are those in drawing. As is generally the case in all the evening schools, the number of pupils gradually diminishes during the school year. In the evening popular lecture courses on agricultural economy are given at the institute. The chemical laboratory attached to the institute has made important studies regarding the cultivation of sugar beets in the vicinity of the city of Bologna. According to the provisions of the will of Professor Aldini, the institute conducts each year, among workers in the mechanical trades and the physico-chemical arts, a competition for a prize of 1,000 lire ($193) for industrial inventions and improvements. This institute is probably the best of its kind in Italy.

TRADE SCHOOL FOR WORKMEN, FABBRIANO.

This school (*Scuola professionale per gli operai*) was founded in 1880 at Fabbriano, a small industrial town of central Italy. Its object is to give instruction of a general nature and in technology in relation to the local industries, paper making, carpentry, cabinet making, engraving stamps for filigree paper, metal casting, and mechanics.

It has two sections, a day course and a night course, each covering four years. It has, in addition, a two-year course in elementary electro-technics, and every second year it has a special course for boiler firemen. It has workshops for practical instruction in wood and metal work. In the day courses instruction is given in kinematics, machine drawing, and plastic art. In the evening courses instruction is given in geometrical, ornamental, and industrial drawing, physics, technology, and mechanics. Instruction is also given in general educational branches. In 1898–99 there were 72 pupils. Graduates easily find positions. The school gives good results, especially for those who do mechanical or wood work. Quite recently it has devoted itself to an industry which has long existed in Fabbriano—the manufacture of paper. It has a budget of about 14,000 lire ($2,702).

CASANOVA INSTITUTE OF ARTS AND TRADES, NAPLES.

This institution (*Istituto d'arti e mestieri Casanova*) was founded by Alfonso Casanova in 1869 and has given excellent results. The school has a budget of about 67,000 lire ($12,931), partly revenue from charitable funds and partly contributions from the ministries of agriculture, industry, and commerce and of public instruction, and from the province, commune, and chamber of commerce. The municipality provides the teachers for the general branches. The school has a large number of pupils. In 1900–01 there were 692, of whom 622 were present at the examinations; 553 were promoted to higher classes and 20 were graduated. The course covers eight years, and the pupils, by means of a series of workshops for carpenters, cabinetmakers, wood carvers, founders, silversmiths, bronze workers, goldsmiths, printers, watchmakers, tinsmiths, machinists, blacksmiths, and electricians, become skillful workers. The school is open all the year for twelve hours a day. The pupils enter the school at about 8 years of age. During the first years they receive only general and elementary education, and then at about 11 years of age they enter the workshops. These are under contract to private manufacturers. The school provides the premises and the manufacturers can not employ other apprentices than the pupils. By this means the pupils receive a very practical training in the various trades enumerated. The director of the school has the right to exclude those workmen employed by the manufacturers who, on account of their loose habits, are not suited

to the educative character of the school. When the work done by the pupils begins to have a value they receive wages. This school is probably the best industrial school of southern Italy and has given to Naples many hundreds of well-trained workmen. It has been much praised by a high official of Krishnuggur in a report, bearing date of March 5, 1901, to the government of India, and that government has decided that the organization of the school shall serve as a model for the Indian industrial schools.

TRADE SCHOOL "SAVERIO ALTAMURA," FOR THE MECHANICAL AND MANUAL ARTS, FOGGIA.

This school (*Scuola professionale per le arti meccaniche e fabbrili "Saverio Altamura"*) was established in Foggia, southern Italy, in 1872, through the efforts of the local chamber of commerce, which contributes 38,000 lire ($7,334) annually toward its support, while the State gives 7,500 lire ($1,448), and the province and municipality of Foggia each give 2,000 lire ($386).

The purpose of the school is to give theoretical and practical instruction in mechanics and electro-technics. The course covers four years, during which instruction is given in general educational branches, industrial, geometrical, and mechanical drawing, physics, chemistry, mechanics and electro-technics, and mechanical technology. There are, in connection with the school, workshops for machinists, molders, carpenters, wood carvers, and electricians. The number of pupils in 1898–99 was 142. The instruction lasts nine hours each day. The theoretical instruction alternates with manual work in the shop.

TYPOGRAPHICAL SCHOOL, MILAN.

This school (*Scuola professionale tipografica*) is well organized and enjoys a good reputation. It was established in 1884 by the labor organizations, and recognized by the ministry of agriculture, industry, and commerce in a decree of June 14, 1888. It has only a modest income, so that the course can not have such development as, for example, the *École Estienne*, of Paris, but it doubtless exerts a good influence upon the local printing trade. In 1899–1900 the school had a revenue of 5,717 lire ($1,103), consisting of contributions from the State, the municipality, the chamber of commerce, the savings bank, the province, some gifts, and small tuition fees from the pupils of certain courses. This is not sufficient to permit the school to keep abreast with the rapid progress of the typographical industry.

The school is intended to give a literary and technical education to printers' apprentices. The lessons are given in the evening and on holiday mornings. From the month of November to the month of April the literary courses are given, consisting of elementary instruction in Italian, French, German, and drawing applied to art. The

technical courses are given from May to October. They comprise a course for compositors, in which are taught the distribution of type, the setting up of manuscript and printed matter of various kinds (prose, poetry, numerals, etc.), the correction of proof, making up, etc.; a course for press feeders (*impressori*), helpers, and pressmen, in which is taught a knowledge of the different kinds of machines, paper, ink, and the operations of feeding and taking off; a course for proof readers, in which is taught the signs used in correcting proof, abbreviations, formulas, punctuation, and a multitude of facts relating to the orthography of the Italian and other languages; a course for bookbinders, and a course in photomechanical processes, in which instruction is given in photography, photozincography, photolithography, phototypy, and photochromy. The last course was established in 1900 with satisfactory results. In order to be admitted to the school the applicant must have an elementary education, have passed the age of 14 years, and have served an apprenticeship of at least 1 year.

The school possesses the typographical materials which serve for practical instruction. To the courses above described must be added the conferences and lectures held from time to time by artists and artisans on special subjects relating to the book industry. The number of pupils matriculated for the year 1899–1900 was 355, but only 180 attended the courses, and 90 appeared at the examinations. This gradual diminution of the number of pupils is a difficulty met with in all evening and Sunday schools.

The *Societa Umanitaria*, a charitable institution of Milan, is arranging with the authorities of the Typographical School to extend its work; that is, to transform it into a *Scuola del Libro*, a complete school for printing and the allied trades. A subsidy of 45,000 lire ($8,685) will be given by the society.

EXPERIMENT STATION FOR THE LEATHER INDUSTRY, NAPLES.

This "station" (*Stazione sperimentale per l'industria delle pelli*) furnishes theoretical and practical instruction relating to the manufacture of gloves, and conducts experiments and researches regarding the tanning and coloring of hides. The lessons are given every Sunday, and in the summer on Thursdays also. The course covers 3 years, but many of the workmen who have been pupils continue to visit the station, in order to keep in touch with industrial improvements. Instruction is given in general chemistry and chemistry applied to the tanning and coloring of hides, and the practical manipulations for tanning and coloring. Workingmen are also admitted, but only to the practical exercises. These are conducted in a workshop attached to the station. In this workshop there were 11,688 hides tanned in 1894–95, 12,344 in 1896–97, and the number has increased each year. For this work there are also paid employees. The hides are from

Italian and foreign sources, and one can notice in the products a certain degree of improvement. Quite recently the station has made experiments with good results in the tanning of kid, which was formerly a monopoly of the French tanning industry. The station furnishes information to the Government regarding questions concerning the levying of import taxes on hides, gives information to manufacturers, and conducts analyses.

In 1898–99 there were 41 students. The school could give better results if the course was longer. As this station is devoted to journeymen tanners, there has been established at Turin, a center where the leather industry is strongly developed, a tanning school for the training of foremen.

SCHOOL OF WEAVING AND DYEING, ARPINO.

While the school at Prato has for its object the training of technical overseers for the weaving and dyeing industries, the school at Arpino (*Scuola di tessitura e tintoria*) is intended for the training of workingmen for the same industries. It accomplishes very good results, although the annual contributions are but 10,500 lire ($2,027). Graduates easily find positions. The instruction is of a practical character, and includes Italian, arithmetic, geometry, drawing, physics, chemistry, the study of coloring matter, of weaving, and of dyeing. Weaving and dyeing workshops are attached to the school.

CASTILLINI SCHOOL OF ARTS AND TRADES, COMO.

Established in a very important industrial center, this school (*Scuola d'arti e mestieri Castillini*) has for its object the instruction of the working classes in drawing (especially for textiles); in modeling and in wood carving; in wood, iron, and stone work; in goldsmithing, etc. It has an annual income of about 11,500 lire ($2,220).

The lessons are given during 2 hours each evening. There are a special course for firemen, a preparatory course of 2 years, and a normal course of 3 years. It is divided into three sections: Industrial art, building and road construction with a special course for master masons, and machinery and metal construction work.

ALBERGHETTI EVENING SCHOOL OF ARTS AND TRADES, IMOLA.

This school (*Scuola serale d'arti e mestieri Alberghetti*) is said to be one of the best in Italy. It has an income of 16,600 lire ($3,204), of which 13,600 lire ($2,625) is the revenue from the Alberghetti fund. The course covers three years and relates to art applied to industry and to mechanics. It comprises, in addition to several branches of general education, geometry, projections, mechanics, plastic art, and geometrical, ornamental, object, mechanical, construction, and architectural drawing. The pupils of the sections of mechanics, wood carving, and cabinetmaking must take a finishing course.

There are workshops for mechanics, cabinetmaking, and wood carving attached to the school. The lessons are given during 3 hours in the evening. In 1898–99 the school had 71 pupils.

WORKSHOP-SCHOOL OF ELECTRO-TECHNICS OF THE HUMANITARIAN SOCIETY, MILAN.

The *Società Umanitaria*, a wealthy organization of Milan, concluded on July 1, 1902, agreements with the Royal Superior Technical Institute and with the Society for the Encouragement of Arts and Trades to establish a *Scuola-Laboratorio di elettrotecnica*. This new school absorbs an existing school of electro-technics founded by the aforesaid Society for the Encouragement of Arts and Trades. The Technical Institute gives the free use of land which was donated by the King. The *Società Umanitaria* gives 100,000 lire ($19,300) for the building, furniture, machinery, apparatus, scientific materials, etc., and a yearly allowance of 35,000 lire ($6,755) for the current expenses. The school will be governed by a council whose members are to be appointed by the Humanitarian Society, the Technical Institute, the Society of Encouragement, the Labor Chamber, the Italian Association of Electro-technics, and the Carlo Erba Institute of Electro-technics. The school will have evening and Sunday courses to give theoretical and practical instruction to the workmen. In the first year the courses will relate to electro-technics, practice in electrical measurements, and design of electrical machinery. The second year will consist of three specialized sections: A section for workmen engaged in the construction of electrical apparatus; a section for workmen engaged in the exercise of electrical apparatus, that is, employed in central electrical stations or in other electrical plants; and a section for workmen engaged in telegraph or in telephone plants.

SCHOOL OF ARTS AND TRADES, LIVORNO.

This school (*Scuola d'arti e mestieri*) was founded in 1886 and comprises the three sections of mechanical and metallurgical industries, decorative arts, and marine machinists. Each section covers three years. There are, besides, two special annual courses, one for boiler tenders (firemen) and the other for electricians. Workshops are attached to the school, one for machinists, one for stonecutters, and also a shop for the production of electricity, containing apparatus for the electrical course.

The instruction comprises several branches of general culture, mechanics, and mechanical technology, general and technological physics, chemistry, metallurgical technology, steam engines, and the duties of enginemen, elementary electro-technics, drawing (geometrical, ornamental, machinery, and projections), decorative painting, plastic

art, stonecutting, machine fitting, dynamo tending, and fitting electrical apparatus.

MUNICIPAL SCHOOL OF ARTS AND TRADES, GENOA.

In 1892 the municipality of Genoa, on the occasion of the Italian-American exposition and the fourth centenary of the discovery of America, founded a school of arts and trades (*Scuola civica d'arti e mestieri*). This school receives young persons who have passed through at least the third elementary class and who wish to learn a trade. The course covers six years, and comprises a "study section" and an "industrial section." The first two years of the study section correspond to the fourth and fifth elementary classes, with the addition of instruction in drawing and manual work. In the last four years the school gives a secondary education of the first grade, with the addition of drawing applied to the arts, machine drawing, plastic art, and physics and chemistry applied to the industries.

The industrial section is the more important from the standpoint of this inquiry. It comprises: (1) Woodwork (carpentry, carving, cabinetmaking); (2) typography; (3) lithography; (4) mechanics; (5) goldsmithing; (6) tanning. The instruction in each of these trades is given in workshops well provided with material, tools, and machines, and operated by contract by manufacturers. Each pupil, from the time his work becomes productive, receives wages which can be deposited, by the use of a pass book, in the savings bank. In 1897 there were established, in the place of the last two trades, a section for artistic ironwork and one for the training of electrical workers. The latter was undertaken by the General Electric Company (*Allgemeine Electricitäts Gesellschaft*), and can not be entered by the pupils until after they have attended the section for machinists for three years.

WORKINGMEN'S SCHOOLS, TURIN.

In each of the larger cities of Italy there are several institutions for the industrial education of workingmen, orphans, foundlings, etc., maintained by the public administration, by associations, by philanthropy, by the income from donation funds, etc. As these establishments all belong to the same class, and do not present any great variation, in order to avoid unnecessary repetition a description is given of the institutions of this type which are found in the city of Turin.

The San Carlo's society for technical schools for workers (*società delle scuole tecniche operaie di San Carlo*) was established in 1848 by a number of working people desirous of improving themselves by mutual instruction. At first they encountered the ill will and opposition of the Government authorities, and had many financial obstacles

and difficulties; but the society has continued to exist and to prosper during a half century of effort, conserving at all times its popular character. It was incorporated in 1879, and owns a large school building. The schools are attended each year by about 100 workers, to whom instruction is given in evening courses with the purpose of making them more proficient in their trades and occupations. Some of the instruction given is of a general or popular nature and does not come within the scope of this inquiry. The other branches relate to industrial art. There are elementary courses in geometrical and ornamental drawing, and the following superior courses: Section of ornamentation (drawing, modeling, form, heraldic, and flower drawing); section of architecture, with a course in the art of masonry (architecture, construction, practical geometry), and a course for cabinetmakers; section of mechanics, with courses in mechanical drawing, practical mechanics, the care of steam engines, and electro-technics.

This school exerts a considerable influence upon the working population. It has an income of from 13,000 to 14,000 lire ($2,509 to $2,702), and awards to the best pupils a number of prizes in money or in deposits at the savings bank from funds established by the public authorities and by philanthropists.

The Archimedes society (*la Società Archimede*) established in 1878 in Turin popular Sunday schools for working men and women for industrial instruction and general education. The number of pupils sometimes exceeds 2,000, but it diminishes during the year. The lessons are given for four hours on Sunday, except the course in plastic art, which is offered every evening. The courses have no fixed limit, the pupils attending the school until they have acquired the necessary education. The school receives a subsidy of about 2,000 lire ($386), and the instructors render their services free of charge. The pupils belong to the working class. The female section is much better attended than the male section. Aside from the large number of branches of a general educational character, there are courses in mechanics, technology, and electro-technics, with a workshop for a course for steam-boiler heaters (firemen).

Most important from the standpoint of industrial education are the evening shop schools and holiday schools for working people (*scuole officine serali e scuole festive operaie*). They are divided into several sections in different parts of the city, and are attended by both sexes. In some sections the lessons are given every evening, in others every Sunday. The instruction is essentially of a trade character. To the evening section for males are attached workshops for lithographers, pressmen, wood carvers, cabinetmakers, and filers, and a practical school of leveling, planimetry, and masonry construction work. The courses cover from one to four years, according to their nature.

The Royal Inn of Virtue (*Regio Albergo di virtu*) is a school founded in the time of the Duke Emanuele Filiberto by the religious brotherhood of St. Paul, for teaching trades to the children of the poor. It was reorganized in 1587 by the King, Carlo Emanuele I, and in the seventeenth century, it was enlarged and enriched. The children of the poor (preferably orphans) from 10 to 15 years of age are admitted, and remain five years, some of them paying a small tuition fee, though the greater number pay nothing at all. The pupils receive an elementary education, and each group pursues a special trade, as lithography, printing, mechanics, wood carving, bookbinding, weaving, etc. Each trade has a well-equipped workshop intrusted to a manufacturer. In this manner during the centuries this institute has developed thousands of poor children into as many good workmen.

By the side of the above may be placed the College of Little Artisans (*Collegio degli artigianelli*), belonging to the *Associazione di carita*. This is a charitable institution, founded in 1850 for teaching trades to poor children. Two hundred children receive instruction in wood carving, printing, bookbinding, cabinetmaking, tailoring, etc., in the workshops, which together form one large building. The association also has an important agricultural colony at Rivoli for training pupils in farm work.

On account of the development of the electrical industry in the city of Turin and complaint of the scarcity of electrical workers, the *Associazione elettro-meccanica Galileo Ferrario* has established a school for evening instruction in electro-technics, physics, mechanics, elementary mathematics, and drawing.

In 1902 there was also established a People's School of Electrotechnics (*Scuola popolare di elettrotecnica*), which gives both theoretical and practical instruction to electrical workmen. The course is of two years' duration, and is given in the evening and on Sunday. The first year comprises the principles of mechanics and physics, electro-technics, and geometrical drawing. In the second year the course is essentially practical and is specialized in the various sections (*montatori elettricisti, installatori interni ed esterni, telegrafisti e telefonisti*). The tuition fee is 5 lire (97 cents) for the first year and 10 lire ($1.93) for the second. The second year is free for those pupils who in the examinations obtain a certain rating. The school has also special practical courses for firemen, policemen, and other persons engaged in public services who have to use electric tools and wires.

The municipality of Turin in 1889 discussed the question of establishing a school of arts and trades "having an especially practical character, for the purpose of producing good workingmen, in order to further the more important local industries." Study of similar institutions in Italy and other countries was made, and the school was opened in 1893. It offers a course covering three years. The pupils pay an

annual tuition fee of 2 lire (39 cents), but if they obtain a rating of eight-tenths in the examinations they are exempted from payment for the following year, and if they obtain such a rating in the examinations for graduation the tuition is refunded. The instruction at the school relates to wood and iron work. In the first two years the pupils work both in the shops for woodworking and in those for ironworking. In the third year they work in one or the other of these shops according to their aptitude or the choice of their parents. Pupils who have attended the elementary school are admitted. In the first year the number is limited to 70. Instruction is given in Italian, free-hand and mechanical drawing, with an elementary course in perspective and industrial drawing, elementary mathematics, kinematics and mechanics, physics, and elementary chemistry. The theoretical courses require four hours each day. During the remaining four hours of the school day the pupils work in the shops. They belong mostly to the working classes. Graduates easily find employment and quickly rise to the positions of skilled workmen and even foremen. The best among the graduates receive as a prize a deposit book in the savings bank and gold and silver medals awarded by the chamber of commerce.

Finally must be mentioned the Cavour School of Chemistry (*Scuola di chimica Cavour*), which was established in 1878 as a result of a donation made by the Marquis Ainardo Benso di Cavour. Its object is to instruct workmen gratuitously in chemistry applied to the local industries. In order to be admitted an applicant must have an elementary education, be at least 15 years of age, and must show that he is a workman or small manufacturer. The course covers two years, but the graduates often ask permission to repeat the second year. The instruction is given in the evening, twice a week. The first course comprises general chemistry; the second, organic, analytical, and applied chemistry. Requests are being made for the institution of a third course or an augmentation of the number of lessons. This school shows good results. The municipality gives the free use of the building and an annual contribution of 2,348 lire ($453).

OTHER TRADE SCHOOLS.

Besides the schools just described, several others which resemble the types spoken of may be noticed. Some of these are schools of arts and trades with evening courses for instruction relating to mechanics, wood and iron work, weaving, decorative arts, etc.; and several also for courses in electro-technics and for steam-boiler heaters (firemen). They are the Jona Ottolenghi Evening and Sunday School of Arts and Trades, (*Scuola serale e domenicale d'arti e mestieri Jona Ottolenghi*), Acqui, the Evening School of Arts and Trades and of Design Applied to the Arts (*Scuola serale d'arti e mestieri e di*

disegno applicato alle arti), Alessandria, the Evening and Sunday School of Arts and Trades (*Scuola serale e domenicale d'arti e mestieri*), Aquila, those of Arezzo and Belluno, and of Casal-Pusterlengo, Catania, Coni, Domo d' Ossola, Pistoja, Portici, Rimini, Salerno, Saluzzo, San Giovanni a Teduccio, Siena, Spezia, Stradella, Suzzara, Trapani, etc. Others have day courses and workshops for various industries, and look to the training rather than to the finishing of workmen. Such are the School of Arts and Trades in the Art Institute of San Lorenzo (*Scuola d'arti e mestieri nell' Istituto artistico di San Lorenzo*), at Aversa, the Technical School (*Scuola tecnica*) of Campiglia, those of Chieti, Colle Val d' Elsa, Cremona, Mondovi, that of Monza, which accomplishes good results, especially in dyeing and weaving, those of Pisa, Pontedera, etc. The city of Naples has two good schools for railway workmen where theoretical and practical instruction is given by the force of the railway workshops. The number of pupils is limited to the needs of the railway service, and the sons of the workmen and clerks of the railway administration are preferred for admission to the schools. The pupils, when graduated, are admitted in the railway workshops and receive a wage. A similar school is established in the royal arsenal of Naples to train workmen and machinists for the naval service.

POPULAR SCHOOLS FOR ADULTS.

By the side of the working people's schools at Turin may be placed the popular schools for adults (*scuole popolari per gli adulti*) of Milan, the holiday schools of masonry (*scuole festive professionali murarie*) of Milan, the School of Design for Pupils in Goldsmithing and the Related Arts (*Scuola di disegno per gli allievi orefici ed affini*) of Milan, the Daniel Manin Institute (*Istituto Daniele Manin*) of Venice, the evening schools for artisans (*scuole serali per gli artieri*) of Rome, etc.

Attention must also be called to the fact that in accordance with reform projects of 1898 some of the nonclassic secondary schools of the first grade, of which there are 283, established under the direct or indirect jurisdiction of the ministry of public education, and which are improperly called technical schools (*scuole tecniche*), are to be transformed into technical schools of the industrial type. It is proposed that instruction in the general branches in these schools be somewhat reduced, and the study of elementary mechanics (two hours in second class and two hours in the third) and industrial technology (two hours in the second class and three hours in the third) added. This project has not been carried out. It is very doubtful whether with such a slight reform it will be possible to give a sufficient rudimentary industrial education. It would be better perhaps to transform these schools completely into schools of arts and trades, with workshops, in accordance with the needs of the localities.

SCHOOLS OF ART APPLIED TO INDUSTRY AND SCHOOLS OF INDUSTRIAL DRAWING.

These schools are of great importance in a country where the artistic temperament is so well developed. This innate artistic character, which one observes among the people in many parts of Italy, makes it possible to give the most ample development to the artistic industries. The schools of art applied to industry can contribute very largely to this development.

These schools are numerous, more numerous even than the industrial schools, and they abound in the villages. There are many which have an income of a few hundred lire only, and which exist by what might be called the heroic efforts of the teachers, who are contented with extremely meager compensation or give their services gratuitously. For these schools, even more than for the professional schools, it is necessary to have a complete understanding between the ministry of agriculture, industry, and commerce and the ministry of public education, which latter has the direction of academies and schools of art.

There should be, in fact, a direct relation between the schools of art and the schools of industrial art. The latter should, so to speak, receive from the former the first principles and forms of the beautiful, in order to make them penetrate the life of the work. The relation must not, however, be too direct. The schools of industrial art must not become schools of art. The instruction must not become academic, but must, on the contrary, respond to the needs of industry and of life. The object should not be simply to make researches to attain the beautiful, but to embellish that which is useful. On the other hand, there should be such a relation as will cause the principles of beauty to influence all the industries, so that all industrial products, even the most modest, will show this research for beauty in form which is a repose and a joy to the eye, as it was during the most glorious epochs of national art. It is especially useful to unite in one institution the industrial school and the school of industrial art. This union often occurs in Italy, a considerable number of the schools spoken of in the preceding chapter having, by the side of the sections for machinists, electricians, masons, weavers, etc., sections for decorative art, wood carving, cabinetmaking, etc., which are sections of art applied to industry.

The complaint is generally made that in the schools of art applied to industry the instruction is too academic. In general there is a great lack of didactic materials. The ministry of agriculture, industry, and commerce, with a proper conception of the needs of this

instruction, has maintained, since 1885, in connection with the Industrial Art Museum at Rome, a workshop for the manufacture of plaster models, reproducing the different types of Italian ornamentation. This laboratory has made two important collections of plaster models, a superior and an inferior, for the different grades of instruction, and has distributed a large number among the schools. It also distributes, from time to time, works on drawing and design, and the periodical entitled "*Arte italiana decorativa ed industriale.*"

Notwithstanding this, the didactic material is very often insufficient and not suited to modern needs.[a] The models are often taken from antiquity, and do not respond to the new expressions which modern life should inspire in the artist. They do not apply to the needs of the private and public life of to-day. The study of the real is not sufficiently developed, nor is enough known of the new artistic tendencies, which are absorbing the forms of beauty in the thousands of details of nature, especially of plant nature, and too strict an adherence is given to traditional artistic forms.

Furthermore, the industrial art schools, as well as the Italian artistic industries, neglect many forms of industrial art which might have a great development and which might give to Italy the first place in the production of artistic novelties (*articles de Paris*). They neglect almost entirely, as may be observed with Mr. Levi, instruction in engraving, guilloché work, chasing, goldsmithing, and jewelry. They neglect the production of silver tableware, which could become an Italian industry, and which is, on the contrary, entirely German. They neglect the cutting of precious stones, work in hard stones, ivory, coral, lava, mother-of-pearl, leather, etc., whereas in most of these industries Italy has in the past been famous.

In view of the limited resources of many of the schools, an arrangement might be made for the loan of models among the schools in order to place them all in a position where they could profit by the new and varying materials and respond to modern needs. It might, perhaps, be possible to arrange for a special loan service through the ministry.

The central commission for instruction in art applied to industry (*commissione centrale per l'insegnamento artistico applicato alle industrie*) exercises a special supervision over these schools. Each year examinations are held at the superior schools of art applied to industry to determine the suitability of candidates as instructors in the schools of applied art. These examinations are regulated by a decree of December 29, 1895, and the said commission exercises a special

[a] See pamphlet of Mr. Primo Levi, already mentioned, pp. 21–31.

supervision by giving judgment upon some of the work presented by the candidates.(a)

There are seven schools of art applied to industry, brief accounts of which follow:

SCHOOL OF DECORATIVE ART, FLORENCE.

This school (*Scuola professionale delle arti decorative*) was founded in 1869, on the initiative of some of the citizens, as a school for wood carvers and cabinetmakers. In 1880 it was transformed into a school of industrial decorative art, for giving art and technical instruction which can better aid the development of the Florentine industries founded on the arts of drawing and modeling. It is thus intended, above all, for the education of young persons engaged in the arts and in wood carving, carving ornaments in marble and plaster, stucco work, decorative painting, wood or metal engraving, goldsmithing, chasing, mosaic, inlaid work, etc. In order to be admitted, pupils must be 12 years of age and must have an elementary education. It is divided into three courses: Elementary, two years; special, three years, and practical, one year. It is further divided into three sections: Decorative architecture, decorative painting, and decorative carving. In 1900 a course for training teachers of industrial drawing was added. The lessons occupy four hours daily. The branches of instruction are as follows: Free-hand, geometrical, architectural, ornamental, and object drawing; study of the styles of decorative ornamentation; plastic art; application to industrial art, with composition exercises, and history of the decorative and industrial arts. In 1898-99 there were 130 pupils, of whom 87 appeared for examination and only 1 was graduated. The school receives annual contributions amounting

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a At a congress of delegates of the schools of art applied to industry held in Rome in 1901 it was proposed, among many other reforms, that the prizes to pupils should consist in books, models, photographs, etc.; that the visits of the pupils to the museums, monuments, workshops, etc., should take place more frequently; that the publication of technical and artistic handbooks, periodicals, models, photographs, etc., should be encouraged; that the use of books, models, etc., belonging to the schools should be allowed pupils; that there should be exposed in the schoolrooms a series of photographs, concisely explained by placards; that the teaching of the history of industrial and decorative art should be more practical; that lectures on special subjects should be given; that small libraries of easy and useful works on industrial and decorative art and on scientific and technological subjects should be kept in the schools, to which pupils could have free access; that each school should possess a collection of objects of industrial and decorative art of the past and of the present, those of the past to relate chiefly to those epochs in which the artistic industries of the region or of the locality attained a high degree of perfection; that provision should be made by the superior schools of industrial art and the secondary schools of general culture, where there is no preparatory course, for the coordination of the courses and programmes; that the schools of industrial art existing in some benevolent institutions should be reformed; that pupils should be admitted free to the national and municipal museums to study, take copies, etc.

to about 32,500 lire ($6,273). The pupils pay a fee of 10 lire ($1.93) per annum. The school gives excellent results.

SUPERIOR SCHOOL OF ART APPLIED TO INDUSTRY, MILAN.

This school (*Scuola superiore d'arte applicata all'industria*) was founded in 1882, with the purpose of giving to workmen already acquainted with the elements of drawing instruction in art applied to the trades which they practice. No tuition is charged, and the lessons are given in the evening. On Sunday lectures are given and art visits are made. The school is divided into three sections—linear drawing, ornamental drawing, modeling. Each section is divided into two courses—one for imitation, the other for composition work. In order to be admitted applicants must have an elementary education and pass examinations in drawing and geometry. The complete course at the school covers six years. To the first section are admitted cabinetmakers and manufacturers of inlaid work, marble cutters, etc. To the second are admitted workers who are employed at decorative painting, engraving, carving, designing for embroidery work, for inlaid work, mosaic, enameling, tapestry, etc. To the third are admitted carvers in wood and in marble, chasers, bronze workers, etc. The school receives annual contributions amounting to 25,000 lire ($4,825). In 1898–99 there were 362 pupils, and of the 259 who presented themselves for examination, 156 were promoted, and 40 were graduated. The school accomplishes good results. It has been said of this school that "it is a model of logic and practice, without prejudice, and at the same time a triumph of the æsthetic sense. * * * The results obtained in all the branches and in all the applications of the instruction are such that nothing better could be desired."

INDUSTRIAL ART MUSEUM, NAPLES.

In connection with the Industrial Art Museum (*Museo artistico industriale*) of Naples are established schools for teaching drawing, modeling, and decorative composition to persons employed in the industrial arts. Instruction is there given in geometrical, ornamental, elementary, architectural, decorative, and industrial drawing, plastic art, history of the decorative arts, etc. There are attached to the schools several workshops for ceramic work, bronze and other metal work, work in silver, gold, enamel, etc., woodwork (artistic cabinetmaking, wood carving, inlaid work, etc.), lithography, and engraving on metal and wood. The lessons are given during eight hours per day in winter and eleven hours in summer. There is a preparatory course of variable duration and a normal course of three years. Students may be admitted to the museum to attend only the instruction in art without going to the workshops. The budget is about 80,000 lire ($15,400).

SUPERIOR SCHOOL OF ART APPLIED TO INDUSTRY, PALERMO.

This school (*Scuola superiore d'arte applicata all'industria*) whose object is to further the development of artistic industries, possesses a museum of ancient and modern objects of industrial art. The course covers three years, and comprises ornamental, geometrical, object, architectural, and perspective drawing; modeling objects; compositions in relief, drawing, and color for the industrial arts; and practical exercises in styles of ornamentation. The lessons are given during three hours in the morning and three hours in the evening. The school has five teachers and a budget of 25,000 lire ($4,825). In 1896–97 the number of pupils was 22, and in 1898–99, 37. In 1898–99, 15 were present at the examinations, of whom 8 were promoted and 6 were graduated.

INDUSTRIAL ART MUSEUM, ROME.

By far the most important of the schools of this class is the superior school attached to the Industrial Art Museum (*Museo artistico industriale*) of Rome, whose purpose is to "further the development of the industrial arts, to dignify and improve the taste, and to spread artistic culture among the working classes." The course covers three years, and the lessons are given in the evening. There are three sections: (1) School of color decoration, with its application to ornamental styles, composition, and exercises in painting; (2) plastic art, with compositions and exercises in decorative ceramics, and work in marble, wood, and plaster; (3) school of plastic decoration for metal work, with compositions and exercises in chasing, engraving, and enameling.

The number of pupils in 1898–99 was 90. Forty-one presented themselves for examination, of whom 26 were promoted and 7 were graduated. Of this institution it may be said that it is praiseworthy in many respects, but it needs a more modern character. The pupils are taught to compose exclusively from subjects of the Italian, Greek, Roman, Byzantine, ogival, and Renaissance styles, and they succeed in the reproduction of the classics applied to some objects, but they ought to be accustomed to give a modern character to modern objects.

This museum is all the more important because, as already noted, the ministry of agriculture, industry, and commerce has established in connection with it a workshop for the manufacture of plaster models for the other schools.

VENETIAN SCHOOL OF ART APPLIED TO INDUSTRY, VENICE.

This school (*Scuola veneta d'arte applicata all'industria*) was founded in 1872, for the improvement of the artistic industries. It comprises a regular course of two years and special courses lasting four years. In the regular course the pupils are taught the necessary knowledge for all branches of decorative or industrial art. In the special courses

they are taught the studies which are directly needed in the special branches of art which the pupil intends to pursue. These special courses are of three kinds: Decorative, ornamental, plastic work; architectural and construction work; drawing. Lessons are given for two hours each day. There are also held at the school Sunday courses for the practical education of decorative workers, in which instruction is given in linear perspective, plain decoration, and the history and technics of the industrial and decorative arts. This school is attended by an average of 200 pupils and has a budget of 23,000 lire ($4,439).

SUPERIOR SCHOOL OF ORNAMENT, TURIN.

Finally, there should be mentioned the Superior School of Ornament (*Scuola superiore d' ornato*) attached to the Royal Industrial Museum of Turin. This school is at present in a transition state, on account of reforms that are being made.

SCHOOLS OF APPLIED ART AND INDUSTRIAL DRAWING.

These are very numerous, and as it is not possible to describe all, this report will be limited to a mention of only the most prominent.

PIEDMONT, PROVINCE OF TURIN.—The greater number of the workingmen's and popular schools, already described, also teach industrial drawing. There should further be mentioned the evening schools of design (*scuole serali di disegno*) opened by the municipality of Turin on January 11, 1805. These schools cost the municipality about 30,000 lire ($5,790) each year, and are distributed throughout the different parts of the city. In these are taught subjects of general culture, free-hand and ornamental drawing, plastic art, machinery drawing, and geometrical and architectural drawing applied to the arts. The lower courses cover two years and the higher courses are unlimited. The matriculation fee is 3 lire (58 cents) per year, but the poor are exempt from its payment. A municipal councilor has said that these schools are veritable jewels, and they have a good influence on the artistic education of the working class. The School of Design (*Scuola di disegno*) of Chieri is a Sunday school maintained by a provident association, and subsidized by the commune. There are two courses, one for ornamental drawing, the other for technological and geometrical drawing. The Evening School of Design Applied to Industry (*Scuola serale di disegno applicato alle industrie*) of Moncalieri is situated in a small town near Turin. It has 20 pupils. Instruction is in the charge of a teacher having the meager salary of 200 lire ($38.60) per year, assisted by two members of the Artists' Club (a club which subsidizes the school), and consists of ornamental, geometrical, and architectural drawing, and ornamental plastic work. The school accomplishes good results. The small school at Pinerolo, an evening school, may also be mentioned. It has a budget of 200 lire ($38.60).

PROVINCE OF ALESSANDRIA.—Here may be mentioned the municipal drawing school at Casale, similar to the preceding. It has two-year courses. The matriculation fee is 3 lire (58 cents), but is refunded to pupils who attend the lessons regularly. The Evening and Sunday School of Design Applied to the Trades (*Scuola serale e domenicale di disegno applicato ai mestieri*) of Nizza-Monferrato was founded in 1881, and is attended by about 80 pupils. Instruction is gratuitous. The annual contributions amount to 1,250 lire ($241). The instruction consists of matters of general education, and of linear and geometrical drawing applied to the blacksmiths', masons', and carpenters' trades. The School of Design (*Scuola di disegno*) of Valenza, an evening and Sunday school, was founded in 1873 by artists' and workingmen's societies, with the object of teaching drawing applied to the trades. It receives annual contributions amounting to 570 lire ($110). The course covers four years, and the school is in session from November 1 to the end of March. Instruction is given in drawing applied to the arts. In 1898 there were 70 pupils. The Evening School of Design Applied to Arts and Trades (*Scuola serale di disegno applicato alle arti ed ai mestieri*) of Castelnuovo Scrivia was founded in 1896. The lessons are given twice a week, the instruction consisting of geometry, and of geometrical, architectural, and applied drawing. The annual contributions are 1,700 lire ($328). The drawing school of Castellazzo, an evening school, was founded by a workingmen's mutual aid society, and reorganized as a result of a donation. Tuition is free to members of the society and their children. Others pay 2 lire (39 cents) per month. It has 40 pupils on an average, and holds two sessions per week. The subjects taught are linear and geometrical drawing, and drawing applied to the industries in which the pupils are engaged. The income is about 500 lire ($96.50), of which the teacher receives 200 lire ($38.60). The School of Design (*Scuola di disegno*) in San Salvatore is an evening school founded by a workingmen's mutual aid society. No tuition is charged. The school is similar to the preceding.

PROVINCE OF CONI.—At Coni there is a school of arts and trades, which, in its programmes, attaches much importance to instruction in applied art. At Ceva an agricultural and workingmen's society has founded an evening school for instruction in applied drawing. It has an average attendance of about 150 pupils. At Racconigi the municipality founded, in 1890, an evening school of drawing, plastic art, and wood carving, for the purpose of giving instruction in practical art. In 1898 it had 74 pupils, nearly all of whom were workingmen. Instruction is given in geometrical, ornamental, and architectural drawing, decorative plastic work, and several general branches.

PROVINCE OF NOVARA.—At Vercelli there was founded, in 1850, the Art Institute (*Istituto di belle arti*), which, in the section for males, furnishes instruction in drawing, architecture, machinery drawing,

plastic art, and wood carving. The institute has workshops for cabinetmaking and wood carving. In the section for females instruction is given in ornamental drawing with its artistic, domestic, and industrial applications. Instruction is gratuitous and is given in the evening during the winter and in the morning during the summer. In 1898-99 the section for males had 393 pupils and that for females 70 pupils. The institute has a large revenue from endowment funds, and receives a subsidy of 500 lire ($96.50) from the ministry of agriculture, industry, and commerce. The School of Art Applied to Industry (*Scuola d'arte applicata all'industria*) of Novara was founded in 1833 as a result of a donation. Tuition is free. The course lasts 4 years and comprises ornamental, geometrical, architectural, and machinery drawing, plastic art, and modeling. Instruction is given in the evening and on Sundays. To be admitted to the school the candidate must prove that he is a workingman. The Drawing School of Varallo was founded in 1778 for evening instruction in different branches of drawing. In the same city, in 1836, was founded a school of carving (*Laboratorio d'intaglio*), a free day school with five-year courses for instruction in wood carving. The income amounts to 2,500 lire ($483), of which 700 lire ($135) is used for subsidies to poor pupils. At Borgo Sesia was established, in 1836, as the result of a donation, a drawing school for training stucco workers, decorators, etc. It is a day school attended by 30 pupils. The income is about 500 lire ($96.50). In the same city the workingmen's association has established a small drawing school, with a Sunday course, with a budget of but 100 lire ($19.30). Another school was founded in 1868 in the village of Alagna, giving evening lessons for artisans. Similar schools for elementary lessons in applied drawing exist in the villages of Valdobbiadene (day school); Mollia (day school), the teacher receiving 153.5 lire ($29.63) annually; Valduggia (evening school); Rosso (evening school), where the annual income is 164 lire ($31.65), of which the teacher gets 150 lire ($28.95), and Santa Maria Maggiore, with day and evening courses. At Domo d'Ossola a school of applied art was opened in 1874, as a result of a large donation from the municipality, its purpose being "to favor the creation and development of small industries." Instruction is given in drawing, ornamental plastic work, and wood carving. The receipts from this donation amount to 4,000 lire ($772), and suffice for the payment of the expenses of the school. The municipality each year gives scholarships of 975 lire ($188) for the poor pupils. At Canobbio an industrial drawing school was founded in 1885, the receipts of which, amounting to about 2,700 lire ($521), are provided by ten public administrations. The school is free and is devoted to the instruction of art applied to the trades, though probably too much attention is given to ornamental drawing. The course covers 3 years, and the lessons are given in the daytime. The school had 54 pupils in

1898–99. At Baveno there is a Sunday drawing school, founded by the Workingmen's Mutual Aid Association. Similar schools were founded by a workingmen's association at Pallanza for evening and Sunday instruction, specialized according to the trade followed by each pupil, and at Invorio Inferiore, by a charitable donation by Giovanni Curioni, for evening instruction, free for inhabitants of the commune, with instruction specialized for each trade. The average attendance is 60.

Other districts of Italy are all more or less sprinkled with evening and Sunday industrial drawing schools for workers, either free or requiring very small tuition fees, and similar to those just described. A few of these may be noted as having certain distinctive features:

LOMBARDY.—At Milan, besides the large number of popular drawing schools, there is a drawing school for goldsmiths' apprentices, for giving theoretical and practical instruction in the evening and on Sundays in the art of goldsmithing and jewelry manufacturing and engraving, founded and directed by a goldsmiths' association. The school gives instruction in drawing, designing for the goldsmith's trade, modeling in wax and in pastilina, and the elementary ideas of chemistry applied to art. In 1898–99 the school had 144 pupils; of the 75 who appeared for examination, 60 were promoted and 12 were graduated. The small school founded at Meda by the Workingmen's Mutual Aid Association has attached to it a workshop for wood carving. At Lissone the Mutual Aid Society of Workers and Agriculturists founded a school of industrial drawing applied to the manufacture of furniture, a very important industry in that locality. The drawing course lasts 3 years, that of wood carving 4 years. In 1898–99 there were 105 pupils. Similar schools, with special application to wood carving, have been founded in many other villages in Lombardy. In the city of Brescia, besides the two public schools, the Moretto communal school (*Scuola comunale Moretto*) was established at the beginning of the nineteenth century for evening instruction in art applied to the trades of carpentering, blacksmithing, painting, stonecutting, etc. It has attached to it a workshop for blacksmithing, machine construction, and carpentering. Quite recently a course in industrial education and electro-technics was added. The excellent evening and Sunday school at Salo has a workshop for carpentering, blacksmithing, and chasing, which accomplishes good results, especially in artistic metal work. At Canturio a good school, devoted to the two local industries of furniture making and embroidery work, was founded, through the initiative of the municipality. The school has a workshop for wood carving and a section for women. The school costs the State, commune, and chamber of commerce 3,725 lire ($719). In 1898–99 it was attended by 165 male and 34 female pupils. The school of industrial art at Varese should also be mentioned. It is divided into two sections: Ornamental work (for decora-

tors, makers of inlaid work, stonecutters, etc.), and construction work. The course covers 4 years, and comprises instruction in geometrical, ornamental, machinery, and object drawing, modeling, the principles of the science of urban and rural construction work, mechanics, and descriptive geometry. Instruction is given in the evening and on Sundays. The school had, in 1898–99, 5 teachers and 182 pupils. The annual contributions from the public administrations amount to 4,750 lire ($917). Other similar schools have been established in a large number of small cities and towns of Lombardy. One of these is the School of Alpine Art and Industry (*Scuola d'arti e d'industrie alpine*), of Bormio, intended for the instruction of peasants in the technical knowledge necessary for the manufacture of various small objects. In the evening instruction is given in geometrical and ornamental drawing, and in plastic art, and during the day in wood carving, gilding, etc. It has 2 teachers and 40 pupils. The income is 600 lire ($116).

Liguria.—Several of the schools of arts and trades also give instruction in applied art. In addition to these may be mentioned the evening schools of applied art at Porto Maurizio, at San Remo, and at Chiavari. The school last mentioned was established by workingmen's associations, has an income of 5,400 lire ($1,042), and in 1898–99 had 53 pupils in its 4-year courses.

Venetia.—At Murano, a small town on one of the islands near Venice, an old and celebrated center of industry for artistic glasswork, the commune established, in 1861, a small school for glassworkers. It is annexed to the municipal museum of glasswork, and has an income of 1,100 lire ($212). This school has a three-year course in drawing and in plastic art applied to the glass industry. Instruction is given during 3 hours on Thursdays and Sundays. In 1898–99 there were 73 pupils. Placed in the most important center of this special industry, this school occupies a position of great importance and can improve the industry by introducing new ideas. At Burano, another little town on an island near Venice, is a famous school for women for teaching the manufacture of laces, which conserves the glorious traditions of this Venetian industry. The Pietro Selvatico School of Design (*Scuola di disegno Pietro Selvatico*), of Padova, has a day course of 5 years, for instruction in carpentering, stonecutting, and wood carving, with workshops for these three trades. An elementary education is necessary for admission. In 1898–99 there were 128 regular and special pupils, of whom 67 appeared for examination and were promoted. Venetia also has a large number of small rural schools for day, evening, and Sunday instruction, some of which give good results in the way of the extension of small industries. The number of pupils at these schools often varies greatly in the course of the year on account of the large temporary emigration. These schools are

established at Chioggia, Mestre, Mirano, Dolo, Feltre, Longarone, Auronzo, Fonzaso, Crespino, Ficcarolo, Polesella, Massa-Superiore, Badia, Polesine, Trecenta, Conegliano, Vittoria, Oderzo, Valdobbiadene, Possagno, Este, Cittadella, Lonigo, Valdagno, Schio, Bassano, Nove, Pordenone, Tolmezzo, Gemona, Cividale, Pieliungo, San Daniele Sant' Ambrogio, Legnano, etc. The flourishing condition of these schools, due mostly to local energy, is remarkable.

Emilia.—The Professional School of Decorative Art (*Scuola professionale per le arti decorative*) of Bologna was founded in 1885 for the purpose of stimulating the development of local industries having for their basis the arts of drawing and modeling. The instruction is divided into two sections, the first for the study of drawing and plastic art, the second for its application to the different trades of wood carving, stucco work, decoration, chasing, etc. The course covers five years, the instruction being given in the daytime and in the evening. The contributions received amount to 5,650 lire ($1,090). In 1898–99 there were 113 pupils. The Dosso Dossi school of Ferrara has one section for fine arts and one for artistic instruction applied to the trades. The drawing school for workers at Reggio was founded in 1797. Besides an elementary course it has two sections, one for designers and the other for modelers. The school is free, but in order to be admitted pupils must possess an elementary education, be between 12 and 25 years of age, and must show that they follow a trade wherein the instruction given at the schools would be useful. The lessons are given in the daytime. The school of Guastalla is similar to that at Reggio, but it attaches more importance to practical applications, having also a workshop for ornamental plastic work. The school of Mirandola was opened in 1852. The lessons are given in the evening and on Sundays, and the course covers three years. It is divided into three sections—into the first are admitted cabinetmakers, carpenters, blacksmiths, and carriage makers; into the second, masons, stonecutters, and machinists; into the third, persons devoted to fine arts, designers, and decorators. Women are also admitted for the study of drawing applied to embroidery, etc. Other schools exist in the smaller towns and villages.

Tuscany.—At Florence there are three public schools of applied art, with evening and Sunday lessons. The most important of these is the school established by the philanthropic fund of De Bardi, which fund amounts to 280,000 lire ($54,040). Important schools exist at Arezzo (day school), Livorno (day school), Pietrasanta, Carrara, Massa, Volterra, Grosseto, etc. The school at Pietrasanta is devoted to workers employed in the marble industry, which flourishes in the locality, the instruction consisting of architecture, ornamentation, object drawing, and modeling. It has two shops for marble work. The school is well attended and accomplishes good results. Pupils who are not residents

of Pietrasanta pay a tuition fee of 18 to 24 lire ($3.47 to $4.63) per year. The income of the school is 6,000 lire ($1,158). The school at Massa has special reference to marble work, and is similar to that at Pietrasanta.

MARCHES.—Here may be mentioned the evening and Sunday schools at Cagli, which furnish a three-year course in carpentering, stone-cutting, decorative painting, pottery, wood carving, etc.; at Fano, at Fossombrone, at Sant' Angelo, in Vado; at Pesaro, at Loreto, at Ascoli-Piceno, at Macerata, at Potenza Picena, etc.

UMBRIA.—There are evening schools for instruction in drawing at Todi, Spoleto, and Narni.

CAMPAGNA DI ROMA.—Aside from the popular municipal schools, Rome has a municipal evening school with a three-year course, which serves as a preparatory school for the Museum of Industrial Art. The studies consist of elementary geometry, drawing in its different branches, including its application to the trades; perspective, plastic art, marble carving, etc. At Velletri there is a free municipal evening school, with a four-year course for decorators, carpenters, masons, and blacksmiths. A shop for wood and stucco work and decoration is attached to the school. About 100 pupils attend the school.

ABRUZZI.—At Chieti there is an evening and Sunday school having a three-year course, and attended by about 100 pupils. The instruction consists of the different branches of drawing and their application to industry, geometry, projections, modeling in clay, wood carving, and lathe work. The annual expenses amount to 4,200 lire ($811). Other similar schools exist at Lanciano and in several villages.

CAMPANIA.—At Naples there are several popular schools of applied drawing, attended by a large number of workers. At Torre del Greco was founded in 1878 the School of Coral Cutting and of Decorative and Industrial Art (*Scuola d'incisione sul corallo e d'arti decorative ed industriali*), for giving artistic instruction regarding the decoration and carving of coral, lava, sea shells, mother-of-pearl, tortoise shells, ivory, hard wood, metal, etc. It comprises two three-year courses, one for carving and inlaid work, the other for the Pompeiian style of decorating; a two-year day course in modeling, and a five-year evening course in drawing. A workshop is attached to the school, the sale of the products constituting an important revenue, a part of which is distributed among the pupils. The school receives contributions amounting to 9,350 lire ($1,805). In 1898–99 there were 52 pupils in the day courses, and 183 in the evening courses. The school gives good results. In the midst of the crisis in the coral industry this school created novelties in coral work which increased the use of that material. The School of Inlaid Work and Carving (*Scuola di tarsia e d'intaglio*), of Sorrento, founded in 1886, has for its object the giving of instruction in the inlaid-work industries and in wood carv-

ing, which are very important in Sorrento, the products of these industries finding a large market among foreigners as "souvenirs of Naples." There is a workshop connected with the school. Instruction is given in the evening and on Sunday, the course lasting four years. It consists of drawing applied to inlaid work in colors, in light and shade, and in ivory, to carving, and to mosaic work. The school has had without doubt a good influence on the taste of the inlaid workers, but there are some that think that the inlaid work of Sorrento has lost something of its former artistic ingenuity.(a) The contributions received by the school amount to 5,790 lire ($1,117). In 1898–99 there were 89 pupils in attendance. In many localities of this district there are evening and Sunday schools similar to those of other districts.

Apulia and Calabria.—Among the several small schools of these two districts the Sunday schools of Maglie and of Bitonto are noteworthy. Although situated in villages and without regular incomes—the former receiving contributions amounting to 3,100 lire ($598) and the latter 1,500 lire ($290)—they give excellent results in wood carving and in stone work, and are examples of the vitality and usefulness of the small schools.

Sicily.—At Palermo, Messina, and Catania there are several popular evening and Sunday schools. Other schools have been founded in smaller towns, generally upon the initiative of workingmen's associations.

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a See article by Mr. Paolo Rispoli on the professional schools of Naples in the Rassegna Italiana, September, 1901.

CHAPTER XI.

TRADE AND TECHNICAL EDUCATION IN SWITZERLAND.

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INTRODUCTION.

The first efforts for the development of a special system of schools for industrial education in Switzerland date from the commencement of the eighteenth century. These efforts took the direction of the establishment of special schools of drawing. Such a school was projected at Geneva in 1704, but the project was not actually realized until 1751. This school served as the model for many of the municipal art schools in Switzerland. In 1762 a drawing school modeled after the one at Strasburg was opened at Basel. Failing, after a few years of existence, it was succeeded in 1796 by a "school of drawing and modeling," founded by the Society of Public Utility of the city. This school, after an existence of ninety years, was converted into a general industrial school by a cantonal law passed December 20, 1886.

In 1780 Johannes Fries, a master carpenter, opened a school of drawing for workmen at Zurich. Another private school of drawing was opened, in 1787, at Saint Gall, and later became a municipal institution. In 1789 a similar school was opened at Winterthur. In 1773 an art school was established at Zurich. Sixty years later it was transformed into a lower industrial school (*untere Industrieschule*). Bern created an art school in 1779.

In 1798 the Helvetic Republic was formed, and ambitious plans were laid for the development of a national educational system. These, however, were not carried out. The individual Cantons continued their efforts to found schools giving instruction of a practical character. In 1811 a factory school was founded at Basel, and in 1820 workmen's schools (*écoles d'artisans*) were established at Aarau. Similar schools were opened at Bern in 1826 and at Zug in 1839. Drawing schools were opened at Geneva in 1814 and at Lausanne in 1821. The Lausanne school, as well as that founded at Geneva in 1751, belonged to the class of industrial art schools.

About this period, or in the early twenties, the first trade school proper, or school for giving instruction in a particular trade, was opened. This was the engravers' school of Geneva. A watchmakers' school was opened in 1824 in the same city. In 1827 a technical institute was founded at Zurich and an industrial school at Aarau. In 1835

superior industrial instruction was incorporated in the programmes of the cantonal schools of Zurich and Aarau. In 1833 Winterthur opened an industrial school; in 1839 Soleure a technical institute, and in 1842 Saint Gall an industrial school. It was during this period that the drawing schools of Ticino, which will be described subsequently, were created. Artisans' schools were created at Chur in 1841, Oberweil in 1844, Carouge in 1845, Frauenfeld in 1846, Bischofszell in 1848, and Lenzburg in 1850.

A new federal constitution was adopted in 1848. Article 22 of this document gave the Federal Government authority to create a Swiss university and a polytechnic institute. In pursuance of this power a federal polytechnic school at Zurich was provided for by the law of February 7, 1854, and formally opened in 1855.

The provision of lower industrial education still remained the duty of the Cantons. Artisans' schools, Sunday schools, drawing schools, and continuation schools, all intended to supply the need of industrial training, sprang up all over Switzerland. In this development a profound influence was exerted by the frequent industrial expositions which were held in the chief cities, as well as by the participation of Switzerland in international expositions.

More and more the movement for trade and technical education took form in the establishment of schools for special trades or the practical application of art to industry. A school of drawing for the textile industry was created at Saint Gall in 1867; a school of art at Bern in 1870; schools of industrial arts at Geneva (city) in 1869, Chaux-de-Fonds in 1870, Geneva (Canton) in 1876, Lucerne in 1877, Zurich in 1878, Bern in 1881; schools of watch making at Chaux-de-Fonds in 1865, Saint Imier in 1866, Locle in 1868, Neuchatel in 1871, Bienne in 1872, Fleurier in 1879, Porentruy and Soleure in 1884; schools of practical work for women at Basel in 1879 and at Zurich in 1880; weaving schools at Zurich and Wattwyl in 1881; a trade academy at Geneva in 1883, and schools for wood carving at Brienz and Meiringen in 1884.

The first industrial museums and depots for models were established at Bern in 1871, at Zurich and Winterthur in 1874, at Saint Gall in 1878, at Basel in 1881, and at Lausanne in 1884. The Technikum of Winterthur, an institution for secondary technical education, was founded in 1873.

The year 1884, however, may be said to mark the point of departure of the modern movement for trade and technical education in Switzerland. Prior to that date, as has been shown, the development of industrial education had been left almost wholly to the individual Cantons. On June 27, 1884, however, the Federal Assembly passed a resolution by which the development of trade and technical education was made a national affair. This resolution provides for the granting of assistance, under certain conditions, to all institutions for trade and

industrial education that desire it. This has resulted in the establishment of new and the development of existing institutions, and has given a great impetus to trade and technical education throughout the country. Since its adoption the number of trade schools has doubled, and other classes of schools, such as drawing schools, workingmen's evening schools, industrial art schools, etc., have greatly increased in number and efficiency. As this resolution sets forth the essential basis of the Swiss system of trade and technical education, its translation is given in full.

ARTICLE 1. With the object of improving trade education the Confederation will grant subsidies to institutions already established or which shall be established for this purpose. However, when an institution shall at the same time pursue another object, such as general education, for example, the federal subsidy shall be granted only in favor of the trade education.

ART. 2. The following are considered as institutions intended for trade education:

Workingmen's schools; trade continuation schools (*écoles professionnelles de perfectionnement*) and trade drawing schools, existing alone or annexed to primary schools; superior industrial and technical institutions; as well as schools of arts and trades, collections of patterns, models, and material for instruction, and industrial museums.

ART. 3. The Confederation may likewise contribute by subsidies toward the expenses for lectures or for prizes awarded after competitions on questions relating to trade education.

ART. 4. The federal subsidies may, subject to the decision of the federal council, amount to one-half of the total expenses borne annually by the Cantons, communes, corporations, and private individuals.

ART. 5. The federal council shall require of the cantonal governments detailed information concerning the employment of the sums mentioned in article 4; it shall take cognizance of the progress of the institutions, and require the transmission of the programmes of instruction, the reports, and the results of the examinations. In determining the amount of the federal subsidy account shall be taken of the fact when there are trained, in the institution to be subsidized, teachers for trade education and especially teachers of drawing for the workingmen's schools and the continuation schools (*écoles de perfectionnement*).

The Confederation shall share, in the same measure, the expenses which are required for the training of persons wishing to devote themselves to teaching in the institutions named in article 2.

ART. 6. The federal council shall enter into negotiations with the Cantons regarding the conditions under which the Confederation will participate in this trade education, and shall, in cooperation with them, adopt any further measures deemed necessary, by contract, if it be found desirable.

ART. 7. The present payments of the Cantons, the communes, the corporations, and private individuals must not be diminished because of the subsidies which the Confederation shall allow. These ought rather to be a stimulus to the fulfillment of greater obligations in the field of the development of industry and of the arts and trades.

ART. 8. The budget of the Confederation shall provide an annual credit of 150,000 francs [$28,950] for the improvement of trade education. This credit may be increased when the necessity for it is felt, and when the financial condition of the Confederation permits it.

For the year 1884 there is opened to the federal council for this purpose a supplementary credit of 100,000 francs [$19,300].

ART. 9. The federal council is instructed, in conformity with the provisions of the federal law of June 17, 1874, concerning popular voting on the federal laws and resolutions, to publish the present resolution and to fix the date when it shall go into effect.

The following are the regulations adopted January 27, 1885, and still in force, concerning the execution of the above resolution relating to trade education:

The Swiss federal council, in execution of the federal resolution of June 27, 1884, in reference to trade education, on the proposition of its department of commerce and agriculture, resolves:

ARTICLE 1. Applications for federal grants toward the expenses of trade education must be made to the federal department of commerce and agriculture through the medium of the respective cantonal government, which must first investigate them and accompany them with its detailed report.

ART. 2. Applications presented for the first time in behalf of an institution must furnish the information concerning it and be accompanied by the documents hereafter mentioned:

A. In regard to organization:
   - *a.* The exact name of the institution and of the place where it is located.
   - *b.* The name of the proprietor.
   - *c.* The date of the foundation of the institution.
   - *d.* The detailed description of the institution—information concerning the organization, the division, the object, the government, the attendance, the conditions of admission for the pupils or the public.
   - *e.* All printed documents or other publications which have reference to the institution, such as laws, decrees, ordinances, regulations, programmes, statutes, annual reports, financial statements, catalogues, etc.

B. In regard to financial condition:
   - *a.* The detailed statement of receipts and expenditures during the last year.
   - *b.* The itemized budget for the year for which the subsidy is requested. These documents must specify accurately the subsidies and other allowances of the Canton, the communes, societies and corporations, and private individuals, and the special purposes to which these subsidies are applied.
   - *c.* Information concerning the existence and, if there are any, the amounts of fees to be paid for attendance at the institution (tuition, admission fees, etc.).
   - *d.* The proposed use of the federal subsidy, which must be made the object of a statement in detail and showing the reasons. New expenditures proposed for the ensuing year must be stated separately from the usual expenditures.
   - *e.* Information as to the amount of the assets of the institution; the balance sheet.

ART. 3. For the schools, including the special courses, the following information and documents must also be furnished:

a. The division into school years, classes, courses, etc., and their respective duration.

b. The number of weeks of school during the year and their distribution over the various months.

c. The programme of instruction—teaching staff, courses of study, number of hours of school per week, arrangement of hours (*horaire*), etc.

d. The number, sex, and age limits of the pupils.

e. An estimate of the actual or probable attendance in the several branches, and information as to whether these branches are obligatory or optional.

f. Information as to whether, and if so, in what manner, the institution trains teachers for trade instruction, particularly drawing teachers for the workingmen's schools and the continuation schools (*écoles de perfectionnement*).

ART. 4. Applications for subsidies for the collections (article 2, paragraph 2, of the federal resolution aforementioned) must be accompanied by the statutes, regulations, and reports which give the necessary information respecting the object of the collection, the right to make use of it, the number who have availed themselves of the privilege of using it.

The statutes must contain definite provisions concerning the disposition which would be made, in case of the dissolution of the institution, of the acquisitions for which the federal subsidy shall have been granted.

ART. 5. Applications for subsidies for itinerant courses, for prizes for competitions in connection with trade education, and for scholarships to persons who wish to devote themselves to teaching in those institutions mentioned in article 2 of the federal resolution, must be presented in conformity with the prescriptions of article 1 above.

Scholarships shall not be granted to candidates who apply for them unless the cantonal government on its part grants one in each case. The scholarship granted by the Confederation may equal in amount that granted by the Canton.

The candidate to whom a federal scholarship is given must agree to present to the federal department of commerce and agriculture, at least once each semester, a report upon his studies, and after their completion to practice teaching in one of the Swiss institutions enumerated in article 2 of the aforementioned federal resolution.

ART. 6. Applications in favor of existing institutions which have already been subsidized by the Confederation must give the information and be accompanied by the documents following:

a. A detailed report upon the progress and results of and the attendance on the institution during the last year. In that which specially concerns the schools this report must take account of the points indicated in article 3 above, and give a brief sketch of the results of the examinations.

b. A detailed programme of the ensuing year.

c. The documents and information enumerated in article 2 above, under the letter B, *a* to *e*, and an explanatory detailed statement concerning the employment of the federal subsidy.

ART. 7. As a rule, the following expenditures must not be included in the estimates for the applications for subsidies:

a. Expenditures for general administration, office expenses, rent and repair of buildings, lighting, and heating.

b. Expenditures for school furniture, furniture for the collections (cases, etc.), school supplies intended for the ordinary use of the pupils (paper, etc.).

On the other hand, the following expenditures may be included in the estimates:

a. Those relating to the raw materials, tools and instruments, apparatus for instruction (in the workshops, etc.), and the collections.

b. Those which are made for certain installations for the special use of the institution making the application.

The federal department of commerce and agriculture shall consider each case separately and decide each time according to the circumstances.

ART. 8. All further information which the federal department of commerce and agriculture shall deem it necessary to demand concerning institutions which lay claim to a federal subsidy must be given to it by the proper person.

ART. 9. Subject to the final decision of the federal council, the federal department of commerce and agriculture is authorized upon its own authority and within the limits of the budget, to pass upon the applications for subsidies made in conformity with article 1.

ART. 10. The subsidies of the Confederation may, according to circumstances, amount to one-half the expenses borne annually by the Cantons, communes, corporations, and private individuals. The subsidies hitherto granted by the Cantons and the communes must not be diminished. Those contributed by corporations and private individuals must, if the department of commerce and agriculture deems it necessary, be guaranteed for a fixed period; if there is default in these the federal subsidy shall be calculated only according to the cantonal and communal subsidies.

ART. 11. The cantonal governments must each year transmit to the federal department of commerce and agriculture for examination and review an inventory (the accuracy of which shall have been certified to by them) of the purchases to which the federal subsidy shall have been applied.

They must, moreover, guarantee that, in case of the dissolution of the subsidized institution, the property acquired shall always be devoted to public uses.

ART. 12. Access to the subsidized collections must be rendered easy; moreover, in so far as it shall be possible, the articles composing them shall be loaned to traveling expositions and private individuals, in consideration of good security, and their reproduction by photography, drawing, etc., shall be permitted.

ART. 13. The Confederation may grant, in favor of a course extending over several years, a subsidy for the whole duration of the course, with the reservation, however, that the subsidy shall be withdrawn in case the course shall not be completed because of the dissolution of the institution in which it is given, or if the results from it are found to be unsatisfactory.

ART. 14. For the purpose of informing itself with respect to the results in the institutions subsidized by the Confederation, the federal

department of commerce and agriculture has the right at all times to make an inspection of these institutions by its own personnel or through deputies, and especially to have itself represented at their examinations.

For this purpose the department shall always be informed of the time appointed for the examinations.

The department shall prepare instructions stating precisely the duties of its experts, and fixing the compensation to which they shall be entitled.

ART. 15. The present regulations take effect at once.

On July 24, 1891, the Federal Assembly passed an order directing that schools and other institutions for the promotion of commercial education should receive support from the central Government in practically the same way as the industrial schools. Finally, in 1895, the system of granting State subsidies was extended to schools for the teaching of domestic economy and trades to women.

Each year the results of the operations of these various orders are fully set forth in an annual report entitled "*Jahrbuch des Unterrichtswesens in der Schweiz.*" From these reports is prepared the following table showing the number of institutions sharing the subsidy of the Federal Government and the income they receive from other sources. This table shows the rapid development of industrial education in Switzerland since the enactment of the law of 1884. Subsidies granted to and expenditures incurred by women's continuation schools, schools and courses for ladies' tailoring and needlework, and schools and courses for cooking and housekeeping are not included in these figures:

SUBSIDIES RECEIVED FROM THE FEDERAL GOVERNMENT AND FROM OTHER SOURCES, AND TOTAL EXPENDITURES, OF INSTITUTIONS SUBSIDIZED BY THE FEDERAL GOVERNMENT, 1884 TO 1899.

Year.	Institutions subsidized.	Subsidy from Federal Government.	Subsidy from Cantons, communes, and private corporations.	Expenditures.
1884	43	$8,225	$58,802	$84,579
1885	86	29,324	99,954	156,691
1886	98	38,672	114,651	185,004
1887	110	42,276	122,893	197,721
1888	118	54,862	139,891	232,085
1889	125	62,023	157,237	268,405
1890	132	65,918	149,208	270,197
1891	139	70,205	164,353	293,829
1892	156	77,928	184,180	337,754
1893	177	86,363	189,359	340,466
1894	185	90,787	215,850	384,917
1895	203	109,576	244,268	425,205
1896	216	122,161	284,232	520,366
1897	212	130,063	291,655	503,396
1898	226	137,471	308,632	532,558
1899	238	151,805	307,866	548,098

For the efficient management of its system of subsidies and for the purpose of improving the industrial schools, the Federal Government has organized a general inspection service. Experts are constantly

occupied in making inspections of the individual schools. They not only assure themselves that all the requirements of the law are fulfilled by the institutions receiving subsidies, but they give suggestions to the directors of schools concerning desirable methods which are practiced elsewhere. Each year they make a report to the Federal Government of the results of their inspections.

As an advisory body there is a "college of experts." Each year this body has an annual meeting under the presidency of the chief of the federal department of industry to discuss general matters of policy regarding industrial education. Other less formal meetings are held by subcommittees during the year.

In order to obtain competent instructors for the various trade and technical courses, and especially for the courses in trade drawing, the department of industry and agriculture secured the creation, in 1885, of special courses for teachers at the Technikum at Winterthur. At the end of each year special examinations are held, and successful participants are given diplomas licensing them to become instructors of trade drawing in technical schools. Two-thirds of the expense of these courses is borne by the Federal Government. The training of teachers is also indirectly encouraged in other ways.

As a means of spreading information concerning the best pedagogic methods for trade instruction and encouraging efforts for its extension, Switzerland has adopted the plan of holding from time to time expositions at which are shown the organization and work of its various industrial and technical schools. Through these expositions it is possible for educators in all parts of the country to keep informed of what is being done in other localities.

The first of such expositions was held at Zurich in 1890. In 1892 another was held at Basel, and in 1896 there was a still more elaborate exhibit on the occasion of the National Exposition at Geneva. Each of these events was made the occasion for a detailed comparative study of the organization, materials used in giving instruction, and the results of existing trade and technical schools. The published reports constitute exceedingly valuable accounts of the industrial school system of the country and of technical education generally. In all of these expositions participation on the part of the schools receiving federal subsidies was compulsory.

As a further means of developing trade and technical education, the Federal Government, in 1891, inaugurated the plan of sending each year one or two experts to study establishments for trade education and the expositions of school work in foreign countries. The reports of these experts have been published in the technical journals, and occasionally as separate memoirs.

For the purpose of insuring the use of the best material appliances for school instruction, the Government has assisted in the support of a

permanent exposition or museum of appliances for instruction at Zurich (*Pestalozzianum*). In 1888 it published and distributed among the schools a catalogue of school articles, models, plaster casts, etc. It has also assisted with its subsidies in the support of the permanent school exhibit at Bern and the industrial museum at Freyburg.

Finally, the Federal Government has assisted in the publication of works relating to technical education. It grants a yearly subsidy to the bimonthly review entitled "*Blätter für den Zeichen- und gewerblichen Unterricht*," the organ of the Swiss Society of Drawing Masters and Masters of Trade Schools. This journal has been consolidated with another publication which formerly received a State subsidy and which was called "*Die gewerbliche Fortbildungsschule*." Financial aid was also given to Professor Gunzinger in the publication of his two volumes on industrial education.[a] In return for the subsidy received copies of the review first named must be furnished each school.

CLASSES OF INSTITUTIONS.

With regard to the character of the education given, the trade and technical educational institutions of Switzerland may be grouped as follows:

1. Technical colleges.
2. Secondary technical schools.
3. Industrial art schools.
4. Trade schools and apprenticeship shops.
5. Housekeeping and domestic-service schools.
6. Industrial continuation and handicraft schools and trade courses.
7. Industrial drawing schools.
8. Industrial museums.

The annual reports on education in Switzerland, previously mentioned, contain lists of all institutions receiving federal aid. As practically every industrial school of any importance claims its right to a share of the appropriations for industrial education, these lists may be considered as a fairly complete enumeration of the schools for trade and technical education in Switzerland. The statistics given after the description of each of the different classes of schools were obtained from the above-mentioned annual report for 1899.

TECHNICAL COLLEGES.

These schools rank with those of the same class in Germany. Their purpose is to give the highest form of technical instruction, the graduates being prepared to enter upon the various engineering professions. There are two schools of this class in Switzerland, the Federal

[a] Der gewerbliche Fortbildungsschüler: Illustriertes Lehrmittel für gewerbliche Fortbildungsschulen und zum Selbststudium. 2 Bände. Herausgegeben von Peter Gunzinger, Professor in Solothurn.

Polytechnic School (*Polytechnikum*) at Zurich and the school of engineering attached to the University of Lausanne. These institutions do not come within the scope of this report.

SECONDARY TECHNICAL SCHOOLS.

These schools occupy an intermediate position between the technical colleges and the trade schools proper. They are intended to educate persons who do not need the superior training of engineers, but at the same time must have a higher theoretical and practical education than is taught in the trade schools. They correspond somewhat to the intermediate technical schools and the schools for foremen of Germany.

These schools do not entirely supplant the technical training of workshops of industrial establishments. On the contrary, students are advised or required to spend one or two years in a practical workshop before being admitted. Usually the instruction relates to architecture and building construction, machinery construction, fine mechanical work, electro-technics, chemistry, and railroad management.

The first school of this type was founded in 1873 at Winterthur, Canton of Zurich. Previous to that time all nonclassical education was given in the "real gymnasia" or in the manual training schools. The Winterthur Technikum gave courses of a more practical nature and its success caused the establishment of similar schools at Burgdorf and Bienne, in the Canton of Bern, and in Freyburg. Other Cantons—Vaud, Basel, Saint Gall, and Geneva—are at present discussing plans for the creation of additional institutions of this kind. The report of a committee for the Canton of Vaud states that the graduates of the schools have achieved marked success in business life and that there are but few prominent positions in Swiss industrial establishments which are not filled by men who have received instruction in schools of this kind.

There are a few general technical schools called industrial schools in the Cantons of Basel Town, Freyburg, and Vaud, which are of a somewhat lower grade than those just mentioned, yet which, on account of their purpose and the subjects taught, may be classed as secondary technical schools. They aim to give boys about to enter a trade such preparatory instruction as can not be secured in the workshop, but which a well-trained workman ought to possess. The age of admission is fixed at from 14 to 16 years, so that immediately after leaving the public schools the pupils may enter these industrial schools before actually beginning work. The instruction consists of both general and technical drawing, bookkeeping, arithmetic, geometry, chemistry, physics, and modeling. Some of the larger schools have arranged special courses for separate trades in order to make the instruction bear as directly as possible on the trade in which the pupil is about to enter. The courses last one and two years.

The following tables show the expenditures incurred for each of these schools and the amount contributed by the Federal Government:

EXPENDITURES OF SECONDARY TECHNICAL SCHOOLS SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton, town, and school.	Expenditures.	Federal subsidy.
Canton of Bern:		
Bienne, Technikum of Western Switzerland	$32,931	$9,023
Burgdorf, Cantonal Technikum	15,425	4,574
Canton of Freyburg: Freyburg, School of Arts and Trades	10,080	3,387
Canton of Zurich: Winterthur, Technikum	45,937	12,279
Total	104,373	29,263

EXPENDITURES OF GENERAL INDUSTRIAL SCHOOLS SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton, town, and school.	Expenditures.	Federal subsidy.
Canton of Basel Town: Basel, Industrial School	$22,203	$7,005
Canton of Freyburg:		
Freyburg, Secondary Industrial School	1,719	512
Freyburg, Industrial Trade School	3,092	579
Freyburg, School of Trade and trade courses for adults	1,879	598
Canton of Vaud: Lausanne, Cantonal Industrial School	5,176	1,255
Total	34,069	9,949

INDUSTRIAL ART SCHOOLS.

The Swiss industrial art schools are for the most part subdivisions of fine art or industrial schools. Exceptions to this general rule are the special schools of industrial art at Lucerne and Geneva. In Chaux-de-Fonds and Geneva art industries are taught in the municipal art schools, and in Bern, Zurich, and Winterthur they are taught at the trade and higher technical schools. Industrial art in Switzerland has not yet reached that stage of specialization which is found in Germany and some other countries. Probably, however, the Swiss industrial art schools will be specialized in like manner when the number of pupils and the funds available permit.

The existing schools make an effort to have special classes for each branch of art industry whenever the number of pupils justifies their formation. In all cases the special needs of the locality in which the school is located are considered in arranging the schedules of studies. Drawing is the basis of all industrial art education, and is duly emphasized. In general it may be said that the schools resemble those of Germany, not having developed any distinctive features.

The criticisms passed on the work of the schools are, first, that the pupils are not always sufficiently familiar with the technique of the industries in which they are to be employed, and do not fully appreciate the limitations which the technique imposes in the execution of designs and patterns; and, secondly, that the schools follow too closely the traditional styles and therefore lack originality in design. Both of these

criticisms have been made of similar schools in other countries and are the natural faults which such institutions must overcome. The reports of the institutions, however, show that these dangers are being appreciated, and efforts are being made to guard against them by sending instructors to visit foreign industrial establishments, foreign schools, and especially international expositions.

The following table shows the amounts expended for the maintenance of these schools and the amount of the federal contribution:

EXPENDITURES OF INDUSTRIAL ART SCHOOLS SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton, town, and school.	Expenditures.	Federal subsidy.
Canton of Bern: Bern, industrial art department of Art School (*a*)	$2,987	$1,312
Canton of Geneva:		
Geneva, Cantonal School of Industrial Arts	22,814	7,315
Geneva, Municipal Schools of Art and Drawing	19,812	6,562
Canton of Lucerne: Lucerne, Industrial Art School	3,876	1,225
Canton of Neuchatel:		
Neuchatel, School of Trade Drawing and Modeling	8,843	2,220
Chaux-de-Fonds, Art School	(*b*)	(*b*)
Total	*c* 58,332	*c* 18,634

a Now a section of the Trade and Industrial Art School, Bern.
b Not reported.
c Not including one school, not reported.

TRADE SCHOOLS AND APPRENTICESHIP SHOPS.

The trade schools of Switzerland cover a wide field and are intended to provide opportunities for the training of those persons who expect to fill the higher positions in industrial life as well as of those who may be classed as skilled workmen.

The founders of the schools have been mainly associations of private persons. They are usually either persons engaged in the industry, as in the case of the silk-weaving school of Zurich which was founded by the Silk Weaving Society, or associations of persons such as the numerous societies of public welfare (*Gemeinnützige Vereine*). Practically all the schools receive subsidies from the Federal Government and from other sources. Some of the schools are still the property of the private persons who established them, but the most important ones have become municipal or cantonal institutions.

The most numerous schools of this group are those for the watchmaking industry and they have reached a high state of development. In practically all such schools the pupils enter at the age of 14 and begin by making small watchmaking tools. They thus learn to file, to use the lathe, and to do other mechanical work. They next make a rough set of the works of a watch. The parts are then carefully finished, special attention being given to the escapement mechanism. Preliminary regulating is next taken up. If the pupil wishes further instruction, he is taught to make the works of a repeating watch, or of

a calendar clock. Finally, as the most difficult and delicate part of the work, the pupils do simple and precision regulating.

All reports agree that these schools have played no small part in placing the Swiss watchmaking industry in its present high state of development.

Apprenticeship shops are intended as a substitute for the instruction which is otherwise given in the shops of master workmen engaged in industry. Pupils who attend are regularly indentured as apprentices, and the instruction given is mainly practical. In Switzerland there are but two subsidized institutions known as apprenticeship shops (*Lehrwerkstätten*) and the character of the instruction given is about the same as that of a regular trade school. On the other hand, some of the institutions known as trade schools require their pupils to be regularly indentured as in an apprenticeship shop. The plan of paying a master workman, who carries on a regular business, to undertake the training of apprentices as is done in some countries does not seem to have been undertaken in Switzerland.

Schools for the trade training of females, which constitute an important group, are included in this class. Their courses of instruction relate either to single trades such as ladies' tailoring, embroidery, etc., or to a group of trades. The courses of instruction in the latter class include garment cutting, dressmaking, plain sewing, embroidery, millinery, artificial flower making, crocheting, knitting, ironing, etc.

The following table shows the expenditures of each of these schools and shops and the amount contributed by the Federal Government:

EXPENDITURES OF TRADE SCHOOLS, APPRENTICESHIP SHOPS, ETC., SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

TRADE SCHOOLS.

Canton, town, and school.	Expenditures.	Federal subsidy.
Canton of Appenzell: Teuffen, weaving institute	$1,431	$290
Canton of Bern:		
Brienz, school of wood carving	7,006	1,042
Porentruy, school of watchmaking	2,904	679
Saint Imier, school of watchmaking and mechanics	7,450	1,891
Canton of Geneva:		
Geneva, school of watchmaking	9,372	3,046
Geneva, school of mechanics	5,584	1,737
Geneva, school for the building trades	8,920	2,504
Canton of Neuchatel:		
Chaux-de-Fonds, school of watchmaking and mechanics	10,193	2,706
Couvet, school of mechanics	3,239	830
Fleurier, school of watchmaking and mechanics	5,471	1,544
Locle, school of watchmaking and mechanics	7,789	1,088
Neuchatel, school of watchmaking	3,314	984
Canton of Saint Gall:		
Grabs, etc., embroidery schools	14,694	3,744
Wattwyl, Toggenburg school of weaving	3,663	965
Canton of Soleure: Soleure, school of watchmaking	3,147	483
Canton of Zurich:		
Winterthur, trade school for metal workers	11,970	1,641
Zurich, school of silk weaving	7,422	1,544
Total	113,569	26,718

EXPENDITURES OF TRADE SCHOOLS, APPRENTICESHIP SHOPS, ETC.—Concluded.

APPRENTICESHIP SHOPS (LEHRWERKSTÄTTEN.)

Canton, town, and school.	Expenditures.	Federal subsidy.
Canton of Bern:		
Sumiswald, apprenticeship shop for clockmaking	$752	$251
Bern, apprenticeship shops	26,491	4,227
Total	27,243	4,478

TRADE SCHOOLS AND COURSES FOR FEMALES.

Canton of Basel Town: Basel, school for women's work (Frauenarbeitsschule)	$16,451	$5,073
Canton of Bern: Bern, school for women's work (Frauenarbeitsschule)	3,291	531
Canton of Freyburg: Freyburg, course in ladies' tailoring	1,410	232
Canton of Glarus:		
Diessbach, course in sewing, knitting, etc. (Handarbeitskurs)	31	8
Hätzingen, course in sewing, knitting, etc. (Handarbeitskurs)	.....	10
Haslen, course in sewing, knitting, etc. (Handarbeitskurs)	31	11
Luchsingen, course in sewing, knitting, etc. (Handarbeitskurs)	62	19
Mollis, course in sewing, knitting, etc. (Handarbeitskurs)	145	54
Nettstal, course in sewing, knitting, etc. (Handarbeitskurs)	105	35
Nitfurn, course in sewing, knitting, etc. (Handarbeitskurs)	25	8
Rüti, course in sewing, knitting, etc. (Handarbeitskurs)	45	13
Canton of Grisons: Chur, school for women's work (Frauenarbeitsschule)	969	154
Canton of Neuchatel:		
Chaux-de-Fonds, trade school for girls	1,083	135
Neuchatel, trade school for girls	2,961	540
Canton of Saint Gall: Saint Gall, school for women's work (Frauenarbeitsschule)	5,051	1,448
Canton of Valais: Bagne, etc., course in embroidery	579	116
Canton of Vaud:		
Lausanne, trade courses for girls	386	116
Morges, trade school for girls	638	162
Vevay, school for sewing	315	48
Canton of Zurich: Zurich, trade school for ladies' tailoring and lingerie	16,153	2,316
Total	49,731	11,029

HOUSEKEEPING AND DOMESTIC-SERVICE SCHOOLS.

The recent movement for the provision of instruction in housekeeping, cooking, and the training of domestic servants, is due almost entirely to the efforts of the Swiss Women's Society for Public Welfare (*Société d' Utilité publique des Femmes suisses*), which was organized in 1888. As a means in realizing its aims this society established schools of housekeeping, which met with such success that in 1895 the Federal Government was induced to grant subsidies to them on condition that their courses furnish a sufficiently complete practical and theoretical instruction on the subject. Courses of less than three weeks, and so-called cooking schools which in reality are only catering establishments, are excluded from the benefits of the federal subsidy. The teachers employed must be persons of broad, general education, who are likely to exercise an elevating influence over the pupils.

Under the stimulus of the federal subsidy, several types of schools have been evolved. The housekeeping school (*école ménagère* or *Haushaltungsschule*) is usually a boarding school adapted especially for young women who wish to have a thorough knowledge of their own housework. It is also a training school for women who expect to take up housekeeping as a means of earning a livelihood. The

pupils do all the housework, cooking, and serving in the school. The courses last from three months to one year.

A second type is that of the school for training domestic servants. The pupils live at the school, and do all the work connected with the housekeeping. The practical instruction relates to cooking, baking, and other kitchen work, house cleaning, sewing, washing, ironing, and gardening. The theoretical work includes domestic economy, theory of nutrition, bookkeeping, and hygiene. The courses last from three to six months. The cost of board, lodging, and tuition ranges between 70 francs ($13.51) and 110 francs ($21.23) for the term.

A mixed type of schools includes courses both for housekeepers and for domestic servants.

In addition to these schools there are day and evening courses in cooking and housekeeping for pupils who live at home. A special effort has been made to provide such courses for working women. Finally there are courses in cooking given in the public schools as a part of the regular instruction.

Normal schools for the training of teachers for the housekeeping and cooking schools have been established at Bern and at Zurich. They are subsidized by the Federal Government.

The next step in advance, that of making instruction in cooking and housekeeping a compulsory feature of the public school work, is now being advocated by the above-mentioned Swiss Women's Society for Public Welfare. In the Canton of Freyburg such compulsory instruction has been introduced in the schools, so that henceforth all pupils on leaving school possess the rudiments of a training in this pursuit.

The following table shows the schools and courses of this class which receive federal subsidies, the amounts of these subsidies, and the expenditures:

EXPENDITURES OF HOUSEKEEPING AND COOKING SCHOOLS AND COURSES SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton, town, and school or course.	Expenditures.	Federal subsidy.
Canton of Aargau:		
Aarburg, housekeeping school	.....	$13
Aarau, cooking courses	$1,055	116
Boniswil, cooking and housekeeping school	1,465	78
Bottenwil, housekeeping school	43	9
Brittnau, housekeeping school	81	14
Lenzburg, school for housekeepers and servants	1,427	169
Menzikon, cooking and housekeeping school	135	56
Reinach, cooking and housekeeping school	314	72
Uerkheim, housekeeping school	58	16
Wittwil, housekeeping school	47	13
Zofingen, cooking and housekeeping school	173	60
Canton of Appenzell, Outer Rhodes: Herisau, people's cooking school	274	104
Canton of Basel Land:		
Arlesheim, housekeeping course	103	39
Gelterkinden, cooking and housekeeping school	1,176	314
Liesthal, cooking and housekeeping school	605	125
Liesthal, cooking and housekeeping courses	291	77
Münchenstein, cooking and housekeeping school	185	39
Muttenz, housekeeping school	128	39
Sissach, school kitchen	97	39
Sissach, cooking and housekeeping school	363	68

EXPENDITURES OF HOUSEKEEPING AND COOKING SCHOOLS, ETC.—Concluded.

Canton, town, and school or course.	Expenditures.	Federal subsidy.
Canton of Basel Town:		
Basel, cooking course	$1,042	$336
Basel, cooking schools	1,617	347
Canton of Bern:		
Bern, school for domestic servants	4,740	579
Bern, cooking and housekeeping courses	797	266
Herzogenbuchsee, housekeeping school	1,471	279
Saint Imier, housekeeping school	4,701	135
Worb, housekeeping school	3,264	309
Canton of Freyburg: Freyburg, trade courses in cooking	1,604	444
Canton of Geneva:		
Carouge, housekeeping school	2,646	830
Geneva, housekeeping school	13,287	4,929
Canton of Grisons:		
Chur, cooking and housekeeping school	1,051	193
Dissentis Mustar, cantonal cooking course	323	58
Canton of Lucerne: Bühl bei Nottwyl, cooking and housekeeping school	1,527	154
Canton of Neuchatel: Chaux-de-Fonds, housekeeping school	880	207
Canton of Obwalden: Cooking courses	283	77
Canton of Saint Gall: Saint Gall, cooking and housekeeping school	3,640	241
Canton of Soleure:		
Aeschi, housekeeping school	170	63
Balsthal, housekeeping school	351	111
Biberist, housekeeping school	300	86
Derendingen, housekeeping school	574	207
Grenchen, housekeeping school	285	102
Kriegstetten, housekeeping school	149	48
Olten, housekeeping school	136	65
Schönenwerd, housekeeping school	165	48
Soleure, housekeeping school	453	87
Canton of Thurgau: Neukirch a. d. Th., housekeeping school	1,857	135
Canton of Vaud:		
Lausanne, housekeeping school	9,256	2,258
Vevay, school for domestic servants	1,139	148
Canton of Valais: Loeche, housekeeping school	779	97
Canton of Zurich:		
Küssnacht, housekeeping school	188	25
Pfäffikon, cooking courses	620	97
Richtensweil, housekeeping school	197	39
Stäfa, housekeeping school	161	41
Winterthur, housekeeping school and courses	1,780	356
Zurich, housekeeping school	8,634	1,206
Total	78,046	16,063

INDUSTRIAL CONTINUATION AND HANDICRAFT SCHOOLS AND TRADE COURSES.

The industrial continuation schools, which are by far the most numerous of any of the classes of industrial schools in Switzerland, correspond in general to the industrial continuation schools in Germany. In Switzerland the specialization of industrial into special trade continuation schools has not reached that stage of development which has been attained in Germany.

In general the Swiss continuation schools cover the field of educational work immediately beyond that of the primary schools, and hence are arranged for pupils over 14 years of age. They are often so closely related to the preliminary courses for recruits (*Rekrutenvorkurse*) that a few words must be given to this peculiar branch of the Swiss educational system.

The law of July 15, 1879, requires that all recruits for the Swiss army shall be examined by federal examiners on the subjects of reading, composition, arithmetic, geography, and the history and government of Switzerland. The results of these examinations are published by the Cantons, the latter being ranked accordingly. This has

caused a wholesome rivalry among the different Cantons, and as a result eleven Cantons have established special compulsory courses, in which persons are prepared for these federal examinations. These courses bear a close resemblance to those of the general continuation schools, and in some Cantons the two are combined.

With regard to compulsory attendance upon general continuation schools the Cantons have pursued different policies. Nine Cantons have made attendance upon these schools compulsory, with the option of substituting industrial continuation instruction. Five Cantons make it optional with each commune whether or not such attendance shall be compulsory within the commune limits. In the remaining Cantons attendance is voluntary.

The time of attendance is usually from three to six hours per week, in the evenings and on Sundays. In a few cases a forenoon or an afternoon per week is devoted to this instruction. In some Cantons classes may not be held after 8 p. m. When instruction is given on Sundays it must be at such hours as will not prevent the pupils from attending church services. The Sunday classes are most frequently devoted to drawing and sketching. Usually the instruction is given only during the winter months.

The Canton of Ticino, in Italian Switzerland, requires each commune to provide at least one continuation school for instruction in drawing. The Canton in this case bears the expense of the teachers' salaries, while the communes defray the other expenses not covered by the tuition fees.

Together with the class of industrial continuation schools may be considered the handicraft schools (*Handwerkerschulen*) and the special trade courses for artisans. Both of these classes of institutions are intended mostly for journeymen and master workmen, and in that respect they differ from the industrial continuation schools. The instruction is usually given in the evenings and on Sundays.

In some cases the trade courses are given in the daytime on week days during periods when business is slack.

The chief points of difference between these two latter classes of institutions are that in the handicraft schools instruction is given regularly to artisans of various trades, while the trade courses are held at irregular intervals, and the instruction in each course is usually devoted to a single trade.

In the handicraft schools much emphasis is given to industrial and trade drawing, the greater part of the time being devoted to that subject. Language, arithmetic, geometry, and trade calculations usually constitute the rest of the programme. Handicraft schools are most numerous in the Cantons of Bern, Zurich, and Aargau.

In the special trade courses the work includes theoretical and practical instruction, and whenever they are held in the daytime they are

so arranged that they can be completed in a short time. They are usually conducted under the auspices of trade guilds, industrial associations, and similar bodies.

The following tables show the total number of industrial continuation schools in Switzerland and their attendance, and a list of the industrial continuation schools, handicraft schools, and trade courses receiving federal subsidies, together with their total expenditure and the amount of such subsidies:

NUMBER AND ATTENDANCE OF INDUSTRIAL CONTINUATION SCHOOLS, BY CANTONS, 1899.

Canton.	Schools.	Attendance.		Total.
		Males.	Females.	
Appenzell, Outer Rhodes	11	316	.....	316
Appenzell, Inner Rhodes	1	(a)	(a)	(a)
Aargau	13	741	.....	741
Basel Land	5	(a)	(a)	(a)
Bern	23	2,380	116	2,496
Glarus	8	484	.....	484
Geneva	7	706	388	1,094
Grisons	4	399	.....	399
Lucerne	2	126	.....	126
Neuchatel	4	496	177	673
Saint Gall	26	(a)	(a)	(a)
Schaffhausen	3	371	.....	371
Schwytz	8	341	35	376
Soleure	11	623	.....	623
Ticino	18	753	.....	753
Thurgau	17	635	.....	635
Uri	1	45	.....	45
Valais	3	24	30	54
Zug	2	156	.....	156
Zurich	30	4,037	.....	4,037
Total	197	b12,633	b746	b13,379

a Not reported. b Not including 32 schools, not reported.

EXPENDITURES OF INDUSTRIAL CONTINUATION SCHOOLS, HANDICRAFT SCHOOLS, AND SPECIAL TRADE COURSES SUBSIDIZED BY THE FEDERAL GOVERNMENT, AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

INDUSTRIAL CONTINUATION SCHOOLS FOR MALES.

Canton and town.	Expenditures.	Federal subsidy.
Canton of Appenzell:		
Herisau	$716	$234
Speicher	188	59
Stein-Hundwyl	179	52
Teuffen	266	88
Trogen	218	73
Appenzell	144	48
Canton of Basel Land:		
Gelterkinden	907	261
Waldenburg	356	135
Canton of Bern: Tavannes	281	77
Canton of Freyburg: Morat	126	40
Canton of Glarus:		
Engi	264	77
Glarus-Riedern	943	347
Mollis	264	97
Næfels	212	68
Nettstal	247	77
Nieder Urnen	253	77
Schwanden	594	170
Canton of Grisons:		
Chur	1,477	492
Davos	907	304
Ems	183	65
Thusis	193	58
Canton of Lucerne: Lucerne	1,901	579
Canton of Saint Gall:		
Altstätten	$334	$101
Berneck	277	80
Buchs	172	58
Bütschwil	157	58
Ebnat-Kappel	201	58
Flawyl	222	79
Flums	230	72
Gams	180	61
Gossau	185	56
Grabs	200	68
Grub	63	19
Kirchberg	154	48
Lichtensteg	234	63
Mels	141	37
Nieder Uzwil	388	131
Ober Uzwil	201	68
Ragatz	425	139
Rapperschwyl	362	94
Rheineck	122	41
Rorschach	475	157
Schennis	187	58
Saint Gall	5,980	1,621
Thal	340	104
Uznach	172	57
Wartau	144	42

EXPENDITURES OF INDUSTRIAL CONTINUATION SCHOOLS, ETC.—Continued.

INDUSTRIAL CONTINUATION SCHOOLS FOR MALES—Concluded.

Canton and town.	Expenditures.	Federal subsidy.
Canton of Saint Gall—Conc'd.		
Wattwyl	$207	$69
Wyl	455	135
Canton of Schaffhausen:		
Neunkirch	319	86
Schaffhausen	1,755	598
Stein	177	44
Canton of Schwytz:		
Art	351	105
Brunnen-Ingendohl	196	50
Einsiedeln	487	181
Gersau	139	43
Küssnacht	188	39
Lachen	336	99
Schwytz	642	147
Wollerau	168	46
Canton of Soleure:		
Balsthal-Klus	458	135
Biberist	113	36
Breitenbach	145	48
Derendingen	354	111
Erlinsbach	217	72
Grenchen	539	185
Hessigkofen	347	116
Kriegstetten	370	120
Niedergerlafingen	353	116
Olten	1,201	389
Canton of Thurgau:		
Amriswil	150	42
Arbon	304	101
Bischofszell	216	77
Diessenhofen	140	52
Ermatingen	145	52
Frauenfeld	$853	$290
Kreuzlingen	491	124
Mühlheim	84	.....
Oberhof.-Münchwilen	150	41
Schönenberg-Kradolf	139	41
Weinfelden	369	98
Canton of Uri: Altorf	405	135
Canton of Valais: Sion	3,117	579
Canton of Zug: Baar	225	63
Canton of Zurich:		
Bassersdorf	234	77
Bauma	287	77
Bülach	164	68
Dielsdorf	141	19
Elgg	231	77
Illnau	244	58
Küssnacht	370	138
Männedorf	241	77
Nanikon	191	58
Oerlikon-Seebach-Schwamendingen	589	174
Pfäffikon	316	77
Rüti	582	154
Richtensweil	229	58
Rykon-Lindau	145	45
Stäfa	348	97
Uster	740	210
Wald	412	116
Wetzikon	345	88
Winterthur	1,552	386
Zurich	48,911	14,282
Total	94,940	27,844

INDUSTRIAL CONTINUATION SCHOOLS FOR FEMALES.

Canton of Aargau:		
Kölliken	$85	$25
Küngoldingen	28	13
Oftringen	31	13
Canton of Appenzell, Outer Rhodes:		
Gais	31	8
Heiden	88	28
Herisau	519	183
Hundwyl	50	13
Grub	12	2
Lutzenberg	26	4
Rehetobel	37	11
Reutte	14	4
Schwellbrunn	12	.....
Speicher	65	20
Stein	47	13
Teuffen	112	37
Trogen	69	23
Wald	21	7
Waldstatt	19	6
Walzenhausen	27	9
Wolfhalden	25	8
Canton of Bern:		
Duggingen	103	14
Münchenbuchsee	165	34
Thun	215	39
Canton of Glarus:		
Nieder Urnen	125	39
Schwändi	34	10
Canton of Schaffhausen:		
Beggingen	77	25
Dörflingen	24	8
Schaffhausen	837	232
Schleitheim	130	42
Stein	111	39
Canton of Soleure: Büsserach	209	66
Canton of Thurgau:		
Affeltrangen	100	29
Altersweilen	33	12
Altnau	68	14
Amriswyl	129	38
Bichelsee	48	15
Bischofszell	85	29
Buch	$29	$11
Diessenhofen	67	23
Dussnang	53	25
Ermatingen	108	35
Ettenhausen	38	13
Frauenfeld	293	97
Göttigkofen	39	13
Guntershausen	96	32
Herrenhof	99	32
Hüttlingen	25	.....
Kesswil	39	10
Langdorf	52	19
Leimbach	35	12
Märstetten	59	20
Matzingen	30	12
Mettlen	35	12
Mühlheim	77	27
Neukirch-Egnach	44	12
Oberaach	35	12
Ober Neunforn	62	15
Pfyn	46	16
Schönenberg	43	12
Stettfurt	48	15
Sulgen	43	14
Tägerweilen	59	17
Wängi	64	32
Weinfelden	53	15
Canton of Zurich:		
Andelfingen	115	29
Dübendorf	53	14
Dynhard-Eschlikon	65	19
Egg	51	9
Hegi	106	29
Hutzikon	38	12
Illnau	72	31
Neftenbach	98	15
Rüti	231	62
Töss	147	48
Turbenthal	25	5
Unter Stammheim	55	16
Winterthur	5,299	1,544
Yberg-Seen	17	.....
Total	11,854	3,496

EXPENDITURES OF INDUSTRIAL CONTINUATION SCHOOLS, ETC.—Concluded.

HANDICRAFT SCHOOLS (HANDWERKERSCHULEN).

Canton and town.	Expenditures.	Federal subsidy.	Canton and town.	Expenditures.	Federal subsidy.
Canton of Aargau:			Kirchberg	$192	$62
Aarburg	$202	$62	Langenthal	520	145
Baden	758	196	Langnau	324	87
Bremgarten	210	3	Münsingen	165	49
Brugg	553	163	Ober-Diesbach	90	21
Frick	185	58	Oberhofen	146	48
Gebenstorf	129	39	Steffisburg	269	82
Lenzburg	287	87	Sumiswald	243	58
Menzikon	419	86	Thun	548	164
Murgenthal	165	53	Wangen	343	120
Muri	199	53	Worb	225	39
Rheinfelden	301	85	Canton of Geneva: Geneva	6,153	1,544
Schöftland	239	39	Canton of Soleure: Soleure	1,957	618
Wohlen	207	69	Canton of Valais: Sion	347	116
Zofingen	427	125	Canton of Zurich:		
Canton of Bern:			Affoltern, Mettmenstetten,		
Bern	6,239	1,614	Hausen	575	174
Bienne	1,019	290	Horgen	247	77
Burgdorf	917	270	Töss	393	116
Herzogenbuchsee	235	77	Wädensweil	319	77
Huttweil	187	48			
Interlachen	816	262	Total	26,750	7,276

TRADE COURSES.

Canton, town, and course.	Expenditures.	Federal subsidy.	Canton, town, and course.	Expenditures.	Federal subsidy.
Canton of Geneva: Geneva, optional evening courses	$2,196	$618	Lausanne, courses in gilding for bookbinders	$81	$31
Canton of Neuchatel: Locle, courses of the Society for Trade Education	1,161	270	Lausanne, trade courses for locksmiths	879	333
Canton of Vaud:			Lausanne, trade courses for wagon makers and horseshoers	338	86
Lausanne, trade courses of the Industrial and Commercial Society	1,203	405	Morges, trade courses	159	55
Lausanne, trade courses for upholsterers	540	179	Vevay, trade courses of the Industrial and Commercial Society	489	116
Lausanne, trade courses for tinsmiths	296	91	Total	7,477	2,237
Lausanne, trade courses for tailors	135	53			

INDUSTRIAL DRAWING SCHOOLS.

The Canton of Ticino is the home of the Swiss industrial drawing schools (*Gewerbliche Zeichenschulen*). As was stated above, each commune of the Canton is required by law to establish a drawing school, and many of these schools are devoted to industrial drawing. This feature of industrial education is one that is of the greatest importance, and justifies the emphasis that is placed on the subject in Ticino. The work covers free-hand drawing, ornamental drawing, the study of the theory of ornamentation, drawing of articles used in the various trades, modeling, figure drawing, drawing from nature, designing, enlarging and diminishing, history of art styles, mechanical drawing and perspective. Coloring is also taught. Some of the schools encourage

the pupils to do original work, such as the designing of textiles, metal work, etc. The Cantons of Appenzell, Bern, Basel Land, and Unterwalden, together with Ticino, have paid the most attention to developing this class of schools.

The following table shows the industrial drawing schools receiving federal subsidies, the amount of these subsidies, and the expenditures for each subsidized school:

EXPENDITURES OF INDUSTRIAL DRAWING SCHOOLS SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton and town.	Expenditures.	Federal subsidy.	Canton and town.	Expenditures.	Federal subsidy.
Canton of Appenzell:			Curio	$423	$58
Bühler	$97	$31	Locarno	1,317	319
Gais	108	32	Lugano	5,422	2,804
Heiden	419	118	Mendrisio	1,163	231
Urnäsch	120	35	Ponte Tresa	(a)	(a)
Waldstatt	73	23	Rivera	370	46
Walzenhausen	224	77	Rovio	(a)	(a)
Canton of Basel Land:			Russo	(a)	(a)
Arlesheim	564	193	Sessa	703	104
Liesthal	591	174	Sonvico	351	54
Sissach	628	193	Stabio	426	64
Canton of Bern:			Tesserete	366	58
Brienzwyler	119	39	Vira Gambarogno	374	75
Meiringen	149	54	Canton of Unterwalden (Lower):		
Saint Imier	1,124	381	Beckenried	79	19
Canton of Ticino:			Buochs	105	29
Agno	683	90	Stanz	421	135
Arzo	681	100	Canton of Unterwalden (Upper):		
Barbengo	84	36	Sachseln, Sarnen	508	168
Bellinzona	1,411	602	Kerns	136	39
Biasca	386	62	Canton of Zug:		
Breno	390	57	Zug	637	245
Cevio	334	64			
Chiasso	439	54	Total	b21,760	b6,911
Cresciano	335	48			

a Not reported.

b Not including 3 towns not reported.

INDUSTRIAL MUSEUMS.

The industrial museums of Switzerland have not developed any special characteristics. They seek to preserve and to classify the best specimens of the work of the different trades and of the different periods. The museums have attempted to popularize the study of industrial styles and inventions by means of lectures and exhibitions. Most of them made special efforts to secure specimens of the best modern work by purchasing articles displayed at the Paris Exhibition of 1900. They also seek to assist the tradesmen by exhibiting samples of products, as, for instance, textile products of recent manufacture, which have been collected or loaned for this purpose. This effort to keep in close touch with current industrial life is one of the best features of the Swiss industrial museums. They also display considerable activity in organizing workshop courses and industrial art courses for artisans.

The following table shows the museums receiving federal subsidies, the amount of these subsidies, and the expenditures for each museum:

EXPENDITURES OF INDUSTRIAL MUSEUMS SUBSIDIZED BY THE FEDERAL GOVERNMENT AND AMOUNT OF SUBSIDIES RECEIVED, 1899.

Canton, town, and museum.	Expenditures.	Federal subsidy.
Canton of Aargau: Aarau, cantonal museum and handicraft school	$7,033	$2,241
Canton of Basel Land: Liesthal, collection of school appliances of the cantonal industrial union	297	97
Canton of Basel Town:		
Basel, industrial museum	4,684	1,436
Basel, historical museum	6,990	1,648
Canton of Bern:		
Bern, permanent Swiss school exposition	310	77
Bern, cantonal industrial museum	7,201	2,243
Canton of Freyburg: Freyburg, cantonal industrial museum	2,329	695
Canton of Geneva: Geneva, museum of decorative arts	4,438	1,235
Canton of Grisons: Chur, collection of patterns and models	488	154
Canton of Saint Gall:		
Saint Gall, cantonal depot of school appliances	95	77
Saint Gall, industrial museum	16,944	4,922
Canton of Vaud: Lausanne, industrial museum	347	116
Canton of Zurich:		
Zurich, depot of school appliances (Pestalozzianum)	592	174
Winterthur, industrial museum	3,478	965
Zurich-Winterthur, central commission	4,370	1,448
Total	59,596	17,588

SUPERVISION OF THE APPRENTICESHIP SYSTEM.

A short account should be given of the extremely interesting system which has been developed in Switzerland for supervising the work of apprentices in the shops, and insuring, as far as possible, that apprentices receive a proper training during the years when they are learning their trades. The end sought, indeed, is to introduce some system of control and oversight that will perform the services formerly exercised in regard to this matter by the old guilds.

The attempt was first made to exercise such a control by examinations to be taken by the apprentices at the end of their terms, and by special courses for boys who were occupied during the day. Afterwards it was recognized that it was desirable to fix definitely the conditions of apprenticeship, to determine its duration, to specify for each trade the work that must be successively performed, to regulate the terms of the contract made between the apprentice and his employer, etc. Finally several Cantons passed laws which confided to the councils of prudhommes, or unions of employers and employees, or to the communes, the general oversight of apprenticeship in the shops.

Basel Town was the first Canton to institute a system of examinations for apprentices in order to determine their qualifications for performing journeymen's duties. This system rapidly extended to the other Cantons of German Switzerland. As the general organization was seen to be susceptible of improvement, the central committee of the Swiss Union of Arts and Trades (*Gewerbeverein*) decided to

centralize the system. A regulation was accordingly adopted providing for a system which, briefly, is as follows:

The central committee of the union has constituted a commission of seven members to have charge of apprenticeship examinations. This commission, acting in conjunction with the local bodies or sections, appoints expert examiners, and determines the conditions of the examinations. An examination consists of the making of a test article—of executing some work under the eyes of the examiners and of giving proof of the general and technical knowledge of the person examined. Diplomas are given to persons successfully passing these examinations. These diplomas are considered by employers as a guaranty that their possessors have a knowledge of at least the fundamental elements, both theoretical and practical, of their trades.

The following figures will give some idea of the importance this system has assumed: In the fall of 1898 and the spring of 1899 examinations were held by the union in 29 sections or districts, at which a total of 1,104 boys were examined. Of these, all but 8 were granted diplomas. The reports of the examinations give the occupations prepared for in detail. Of the 1,096 boys and girls given diplomas, 156 were joiners, 149 locksmiths, 87 machinists, 63 tailoresses, 46 seamstresses, 46 painters, 40 tinsmiths, 36 ladies' tailoresses, 36 shoemakers, 34 tailors, 32 blacksmiths, 31 wagon smiths, 29 carpenters, 24 gardeners, 20 bakers, 20 saddlers, 17 bookbinders, 15 metal drawers, 14 coopers, 13 instrument makers, 13 upholsterers, 11 wood turners, and 11 potters, while the others represented 66 different occupations.

The Swiss Merchants Society (*Société suisse des Commerçants*), it may be remarked, conducts similar examinations of persons preparing for commercial occupations.

In the French Cantons much the same system of apprentices' examinations has been adopted within recent years, though here the matter instead of being left to a private society has been undertaken as a governmental duty. Neuchatel, Geneva, Vaud, and Freyburg have all passed laws on this subject. The law of Neuchatel was passed November 21, 1890; that of Geneva October 15, 1892; that of Freyburg November 14, 1895, and that of Vaud November 21, 1896. The Geneva law was replaced in 1899 by the law of November 25, 1899, regarding the work of minors. All of these laws provide that the serving of apprenticeships shall be subjected to official supervision to be exercised through the local authorities, employers' associations, or councils of prudhommes. They fix the duration of apprenticeship, determine the relative duties of the master and the apprentice, and prescribe examinations to test the progress made by the apprentices. Copies of the laws of Neuchatel and Vaud were published in Bulletin No. 26 of the United States Department of Labor, in the article

describing the labor laws of Switzerland. As this legislation relates so directly to the problem of trade training, it is here reproduced:

NEUCHATEL.—Following is the law concerning the protection of apprentices passed by the Canton of Neuchatel, November 21, 1890:

For the purpose of elevating apprenticeship and developing the professional value of workingmen in the various arts and trades practiced in the Canton, and especially in the various branches of watchmaking, on the report of the council of state and a special commission it is decreed as follows:

Supervision of apprenticeship.—1. Apprentices in each locality shall be under the supervision of the communal authorities. This supervision, according to the needs and importance of the localities, may be intrusted by the communal council to a special apprenticeship commission composed of an equal number of employers and employees possessing special qualifications for this duty.

2. In localities where there are councils of prudhommes these bodies must exercise, subject to the control of the communal authorities, the supervision of apprentices for which no special supervision shall have been organized by the unions (*syndicats*) of their trades, in conformity with article 3, that follows.

3. In places where employers and workingmen of the same trade have formed trade unions, these bodies may, upon their request and the special decision of the council of state, be invested with the mission of supervising, under the control of the communal authorities, apprentices in their trades. Before undertaking this duty a union must prove that it represents at least a majority of the persons, employers, and workingmen interested, and each year must make a report to the communal council concerning the results of its supervision. This supervision must be exercised by a committee half of whose members are elected by the employers' union and half by that of the employees.

4. If there exists only one union, either of employers or employees, to represent the interests of a trade, it may nevertheless demand that the supervision of apprentices in its trade be intrusted to a committee composed of an equal number of employers and employees belonging to the trade, half of whose members are elected by the union, provided that it shows that it embraces among its members a majority of the persons interested. The communal council will elect the other half from among the class not represented by the union.

5. The delegates of the communal authorities, as well as those of the commissions charged with the supervision of apprentices, shall have the right to visit at any time the apprentices in the shops where they work and control the course of their apprenticeship.

6. Among other things, they must assure themselves that the apprenticeship instruction is not neglected, and that the employer either himself instructs or causes the apprentices to be otherwise instructed in a gradual and complete way in the profession, art, trade, or branch of trade which is the object of the apprenticeship contract.

7. If in the course of their supervision, or as the result of complaints, they discover acts of abuse, negligence, or bad treatment, they must intervene immediately for the protection of the apprentice, and at the same time notify his parents, guardian, or the commune which has control over him.

8. An employer is prohibited from employing an apprentice without the execution of a written contract setting forth the duration of the apprenticeship, the conditions as regards remuneration and, where necessary, as regards board and lodging, and the reciprocal obligations of the parties, which contract must be signed by the father, mother, or legal representative of the apprentice. This contract must be exhibited to the delegates charged with the supervision of apprentices whenever they request to see it.

9. The employer is likewise prohibited from employing an apprentice in work or services other than those relating to the exercise of his trade, except, however, in exceptional cases or as regards certain work or services sanctioned by usage and permitted by the authorities having the supervision of apprentices.

10. Each apprentice must be allowed during the work period such time as is necessary for the performance of his religious duties, or the scholastic instruction required by law.

11. The normal hours of labor per day must not exceed 10 for apprentices from 13 to 15 years, and 11 hours for those more than 15 years of age, inclusive of the time devoted to scholastic and religious instruction. In general, no night work shall be imposed upon apprentices, nor shall they be required to perform any work in their trade on Sundays or holidays. By night work is meant work performed between the hours of 8 p. m. and 5 a. m.

12. Exceptions from the preceding restrictions may be permitted in the case of trades and industries which require night work, or which must be exercised on Sunday, but the council of state, as well as the communal authorities and the supervisory commissions, shall always have the right to require that these exceptions be specially authorized.

13. There shall be instituted by the council of state in the department of industry and agriculture a commission, in which must be represented as far as possible the various trade unions officially recognized, having as its duty the study of the improvements that can be introduced in the service for the protection and supervision of apprentices, and the means of continually increasing the value of apprenticeship and the technical training of workingmen. It shall also, upon the recommendation of the apprenticeship commissions and the trade unions, prepare the programme of apprenticeship examinations, as hereafter provided.

Examination of apprentices.—14. It shall be the joint duty of the department of industry and agriculture, the communal councils, and the apprenticeship commissions to organize examinations for the purpose of determining if the apprentices have acquired during their terms of apprenticeship the technical knowledge and professional aptitude necessary in order that they may exercise with intelligence and profit the trade they have chosen.

15. No person shall be permitted to take these examinations unless he is an apprentice in Neuchatel or one of the other Swiss Cantons, is less than 25 years of age, and has prosecuted at least half of his apprenticeship with an employer resident in the Canton.

16. These examinations shall consist of inquiries concerning the theory of the technical elements which it is considered should be known by the apprentice, but chiefly of the execution of practical tasks, so that it may be possible to judge of his skill and knowledge in respect to the rules and practices of his trade.

17. Diplomas indicating the results of the examinations shall be

given by the department of industry and agriculture to those apprentices who show a sufficient capacity for the practice of their profession.

18. There shall also be given to the apprentices whose examinations show the most favorable results prizes and recompenses consisting of deposits in the savings bank, books, or instruments or tools made use of in the trade which they intend to follow. Scholarships may also be accorded to those apprentices giving evidence of exceptional aptitude and desiring to further perfect themselves in the practice of their art or trade. The council of state shall fix the number and value of these scholarships, as well as the conditions under which they will be awarded.

19. Provision must be made each year for an appropriation of not less than 3,000 francs [$579] to be distributed in prizes to apprentices receiving diplomas.

20. The objects made and presented at the examinations by the apprentices receiving diplomas must, in general, be publicly exhibited, with mention of the name of the apprentice making each, the results of the examination, and the name of the employer.

21. Candidates for apprenticeship diplomas must register themselves at least 3 months before the termination of their apprenticeship either with the commission having charge of the supervision of apprentices in their districts or in their trades, or with the communal council.

22. The apprentice who fails upon an examination shall not again present himself for examination until at least 3 months have elapsed.

23. The examination of candidates for apprenticeship diplomas shall be by a jury of 3 members, of whom at least 2, one an employer and the other an employee, must belong to the trade followed by the apprentices. If the conditions of the examinations require it, this jury may be composed of 5 members, of whom at least 4, 2 employers and 2 employees, must belong to the trade. These juries are appointed by the apprenticeship commissions where there are such bodies, otherwise by the communal council.

24. All the provisions of this law apply equally to female apprentices.

Penalties.—25. Whoever is guilty of breaking article 8 of this law shall be punished by a fine of from 10 to 50 francs [$1.93 to $9.65]. Whoever breaks articles 9, 10, or 11 shall be punished by a fine of from 50 to 100 francs [$9.65 to $19.30].

26. The present law shall enter into force after having been approved by the referendum.

VAUD.—Following is the law concerning apprentices passed by the Canton of Vaud, November 21, 1896:

General regulations.—1. The present law relates to apprenticeship in industry, in the handicraft trades, and in commercial establishments. Its provisions constitute public law, and can not be changed by private agreements.

2. In cases of doubt as to whether a person is subject to this law, the apprenticeship commissioner shall decide, from whose action an appeal may be taken to the department of industry and agriculture.

3. All documents in reference to apprenticeship shall be free from stamp duties. Certificates, proofs, and forms shall be gratuitously provided. The forms may be procured from the communal chancellor and the clerk of the industrial courts.

4. It is unlawful to hinder an apprentice from fulfilling his duties

or to induce him to leave his apprenticeship. Whoever, contrary to law, breaks an apprenticeship contract is liable for damages.

5. Whoever has been deprived of his civil rights by a judicial order may not have apprentices during the period of his punishment.

Apprenticeship contracts.—6. The conditions of each apprenticeship must be incorporated at its commencement in a written contract, for which the official form must be used.

7. Three copies of the contract must be made, one of which must be given to the clerk of the industrial court or the communal clerk, who shall transmit it to the apprenticeship commission, and the other two shall remain in the hands of the master and the apprentice or his legal representative.

8. The parents who apprentice their child become parties to the apprenticeship contract in respect to seeing that the apprentice fulfills his legal and contractual obligations.

Duties of the master.—9. It is the duty of the master to instruct the apprentice in a methodical and thorough way in the occupation or specialty to which the contract relates. He may on his own responsibility intrust this duty to a foreman or other competent workman. He is further obligated to see that the apprentice pursues his technical instruction, and to allow him the necessary time during working hours for this duty. He is prohibited from employing the apprentice in household or other work that does not relate to the trade he is learning.

10. The master must care for the apprentice, and may use paternal discipline if the apprentice is not under the direct supervision of his parents or legal representative. He must keep him at work and look after his development. He must inform his parents or legal representative if he is guilty of any serious misdeeds or shows evil tendencies. He must in like manner give notice if the apprentice becomes ill, or absents himself, or if any other event occurs that makes the intervention of the parents desirable.

11. The master is bound to treat his apprentice well, to give him no bad advice, nor set him any bad example, and to see that he receives no bad treatment on the part of the workingmen or others belonging to his family.

12. The master must care for the health and strength of the apprentice and see that he is protected from overexertion or dangers which are not peculiar to the trade. He must make him mindful of the dangers of the trade, and show him how they can be avoided. He must insure him against industrial accidents, and bear half the cost entailed by such insurance. Exceptions, however, may be made through order in the case of industries presenting no dangers, in which case the employer still remains liable.

13. The hours of labor of the apprentice, including the time necessary for religious, ordinary, and technical instruction, must not exceed 10 per day. As an exception the period may be extended to 11 hours upon the condition that the weekly period does not exceed 60 hours. An unbroken rest of at least 1½ hours must be allowed at noon. The apprentice must not work at night nor on Sundays. Work between the hours of 8 p. m. and 5 a. m. is considered as night work.

14. When the exceptional conditions of a business are such as to make it seem desirable, the administrative council may grant exemptions from the provisions of article 13. Where the conditions are such as to require it, the apprenticeship commission or its delegate may grant permission for a lengthening of the labor period, provided that the

periods of rest are lengthened in a corresponding manner. This permission must be in writing, and must not be for more than a month nor be renewed more than 3 times in a year.

15. If the apprentice lives with his master, the latter must supply him with a clean living room, healthy food, and, in case of temporary sickness, medical attendance, and, when no other agreement has been made, provide for such washing, lighting, and heating as may be necessary.

16. On the conclusion of the apprenticeship term the master must provide the apprentice with a certificate signed by himself, which shall contain only information concerning the trade of the apprentice and the length of his apprenticeship. If this certificate is not given by the master the apprenticeship commission may, at the request of the apprentice, provide one. The master is prohibited from dismissing the apprentice before the end of his term, except upon justifiable grounds.

Duties of apprentices.—17. The apprentice owes obedience and respect to his master. He must work with diligence and conscientiousness under his supervision and advice.

18. He must attend the trade instruction which is given in his locality or near by, so far as it relates to his trade. The apprenticeship commission shall decide concerning the extent of this obligation.

19. He is prohibited from revealing the trade secrets of his master, or from informing strangers concerning his knowledge or business.

20. He is also prohibited from absenting himself without permission except upon sufficient excuse.

21. He is likewise prohibited from quitting his apprenticeship before the end of the term except upon justifiable grounds.

Supervision of apprenticeship.—22. Apprenticeship matters shall be watched over by apprenticeship commissions created by the industrial courts. In those districts which have no industrial courts the apprenticeship commissions shall be created by the administrative authorities (*Regierung*). The apprenticeship commissions are under the supervision of the department of industry and agriculture, which may delegate this duty partly or wholly to a special official.

23. The commissions or their delegates shall look after the exact observance of the law, the execution of the regulations, and the apprenticeship contracts. They must inform themselves as to whether the master instructs his apprentice in his trade or specialty in a complete and methodical manner. They must likewise see that the apprentice is not given work injurious to his health or beyond his strength. They may grant permission for the temporary extension of the work period (arts. 13 and 14). They must organize and oversee the apprenticeship examinations.

24. The commissions or their delegates must receive the complaints of the masters and of the apprentices or their legal representatives, and transmit them to the proper authorities. According to their judgment they must prepare regulations and make the rules necessary in relation to the matter of the breaking of apprenticeship contracts. They must inform the legal representatives of the apprentice whenever their intervention is necessary. They must furnish the apprenticeship certificate when the master fails to do so. They may, upon their own initiative or upon request, take an apprentice out of his apprenticeship if they are satisfied that the master does not possess the necessary technical knowledge, does not fulfill his duties toward the apprentice, or gives himself to drink, or upon other grounds.

25. A supervisory council in relation to apprenticeship shall be created in the department of industry and agriculture, whose duty it shall be to study all means of improvement which the supervision of apprenticeship matters brings up, and the means by which the value of the apprenticeship system or the technical instruction of workingmen can be increased. It must organize and supervise the apprenticeship examinations in the Canton. For this purpose it must give the apprenticeship commissions the necessary instructions.

Apprenticeship examinations and conditions of apprenticeship.—26. Examinations shall be held under the supervision of the department of industry and agriculture to determine if the apprentices have received or possess a satisfactory practical and theoretical knowledge. A special regulation shall determine the more exact conditions for the regulation of these examinations.

27. The department of industry and agriculture shall give a diploma to each apprentice who, at the end of his apprenticeship, satisfactorily passes the examination. This diploma shall contain information concerning the result of the examination and the work and behavior of the apprentice during his term of apprenticeship. The results of the examination of the apprentices receiving diplomas shall be published, with their names and those of their masters.

28. Those apprentices who pass the examination with very good results may be given prizes, such as deposit books in savings banks, books, or instruments or tools which are necessary in their trade. Rewards may also be given to those who have instructed these apprentices.

29. Those apprentices who show special capacity in their examinations and desire to be still further instructed may be given stipends.

30. Upon the request or proposition of the communal council and the apprenticeship commission, the administration may make State contributions to (a) communes or associations that maintain courses for trade instruction; (b) industrial enterprises which take special care for the development of worthy apprentices; (c) those young persons who have the necessary capacity but not the necessary means to complete their apprenticeship term, with the coassistance of their native communes, and according to a tariff drawn up by the administrative council.

31. The communes must defray half the cost entailed by the examination of apprentices and the supervision of apprenticeship.

Civil disputes.—32. Disputes concerning apprenticeship shall be decided by the industrial courts, and when there are no such bodies, by the apprenticeship commission, from whose decision an appeal lies to the supervisory apprenticeship commission when the matter in dispute exceeds 500 francs [$96.50]. The procedure is determined by the law of November 26, 1888, in relation to industrial courts, so far as its provisions apply in a direct or analogous manner.

Penalties.—33. Infractions of this law may be punished by the apprenticeship commission by fines not exceeding 200 francs [$38.60]. When the fine exceeds 50 francs [$9.65] an appeal may be made to the appellate court of the industrial court, and in the absence of such a court, to the supervisory apprenticeship commission.

The concluding sections of the act give certain provisions regarding the manner in which the law shall go into force that are not of permanent interest, and therefore are not reproduced.

These laws in practice have given excellent results. The Canton of Neuchatel has established for each of 56 different trades a programme indicating the successive work that must be executed by the apprentice each quarter during his apprenticeship, and the programme of the examination, including the test piece of workmanship, that must be passed before a diploma is granted. These programmes are reported to be very useful to all classes concerned—to the apprentice, who thus knows what is expected of him; to the employer, who is guided in his instruction of the apprentice, and to the parents. The following table gives the number of diplomas granted in the different trades in each of the three Cantons of Neuchatel, Geneva, and Vaud, the last year for which information is available. It is of interest to note the great specialization of trades in the different industries:

APPRENTICESHIP DIPLOMAS GRANTED IN ACCORDANCE WITH THE APPRENTICESHIP LAWS IN THE CANTONS OF NEUCHATEL, GENEVA, AND VAUD.

Industries and occupations.	Neuchatel, 1898.	Geneva, 1899.	Vaud, 1899.
Watchmaking, jewelry, and fine metal instruments:			
Watch ring and pendant makers	3	.....	.....
Jewelers	.....	1	.....
Enameled dial makers	1	.....	.....
Chain makers	.....	3	.....
Metal basin makers	1	.....	.....
Assemblage and distribution of parts	6	.....	.....
Wheel gilders	1	.....	.....
Escapement makers	14	.....	.....
Case makers	2	.....	.....
Engravers and chasers	1	1	.....
Fine metal workers	17	4	12
Machinists, teeth cutters	.....	2	.....
Gold case mounters	4	.....	.....
Watch jewel setters	1	.....	.....
Case polishers and finishers	6	.....	.....
Regulators	3	.....	.....
Watch spring makers	1	.....	.....
Makers of screws and watchmaking accessories	1	.....	.....
Other occupations	2	.....	.....
Total	64	11	12
Food products, clothing, etc:			
Butchers	2	.....	3
Bakers	23	4	16
Pork butchers	.....	2	.....
Confectioners, pastry bakers	9	7	5
Hairdressers	1	3	2
Shoemakers	.....	.....	3
Cooks	1	1	.....
Druggists	.....	1	.....
Spinners	1	.....	.....
Seamstresses	15	3	8
Milliners	4	3	.....
Furriers	.....	1	.....
Ironers	3	3	8
Tailors	1	1	4
Women's tailoresses	52	37	83
Children's tailoresses	4	5	.....
Men's tailoresses	.....	1	3
Total	116	72	135
Wood, leather, metal and construction work:			
Coopers (bushelmakers)	.....	.....	1
Carpenters	.....	4	2
Wagon smiths	3	.....	4
Boiler makers	2	.....	.....
Architectural draftsmen	.....	3	.....
Cabinetmaking	8	3	6
Tinsmiths	2	2	2
Surveyors	.....	2	.....
Gardeners	13	3	6
Horseshoers	3	.....	.....
Joiners	6	4	9
Pattern makers	.....	2	.....
Iron-pattern makers	.....	1	.....
Carriage painters and letterers	1	5	.....
Stove makers, sheet-iron workers	3	3	.....
Carvers	.....	1	.....
Saddlers	.....	1	5
Locksmiths	7	6	21
File cutters	.....	.....	1
Stonecutters	.....	2	.....
Upholsterers	4	3	7
Coopers	.....	.....	1
Wood turners, finishers	.....	1	.....
Total	52	46	65
Commerce, printing, bookbinding:			
Commerce (clerks)	2	14	18
Sheathe makers	4	.....	.....
Printers	3	4	5
Lithographers	1	.....	.....
Photographers	1	.....	1
Bookbinders	2	1	3
Saleswomen, etc	.....	6	.....
Total	13	25	27
Total for all industries	245	154	239

INDIVIDUAL SCHOOLS.

The following pages contain descriptions of a few of the important trade schools in Switzerland, arranged in the same order as in the classification already given:

SECONDARY TECHNICAL SCHOOLS.

The three schools of this class selected for individual description cover, it is believed, the whole range of subjects taught in the secondary technical schools of Switzerland, and hence it is not necessary to describe the others. While the schools of Bienne, Burgdorf, and Freyburg belong to the same class, they differ considerably both in the subjects taught and in the degree of prominence given to practical work, as will be seen in the detailed descriptions which follow. The Freyburg school also has a division for apprentices.

THE TECHNIKUM OF WESTERN SWITZERLAND, BIENNE.

This institution was established in 1890 by a resolution of the municipal council of Bienne, merging the schools of watchmaking and of industrial art, existing at that time as separate institutions. At the same time there was added a school of electrical and mechanical engineering. In August, 1891, a school was also opened for persons desiring to prepare themselves for positions in the railway service, which later, in the spring of 1900, was expanded so as to include the postal, telegraph, and custom-house service. The institution now embraces five distinct schools, as follows:

A school of watchmaking; a school for machinists, electricians, and fine instrument makers; a school of industrial arts and architecture; a school for railway, postal, telegraph, and custom-house service employees, and a preparatory school for pupils not sufficiently advanced to begin the regular work.

A commission appointed by the municipal council exercises a general supervision over the institution, with special committees directing the affairs of each separate school.

The faculty is composed of a director, 27 instructors, and 6 assistants.

Applicants for admission must be 15 years of age and must have completed the course of the primary school of the city, or its equivalent. Pupils who do not possess a sufficient knowledge of mathematics are given supplementary instruction in this branch to make up their deficiency.

The tuition fee for residents of Switzerland in the school of watchmaking and in the department for fine instrument makers is fixed at 10 francs ($1.93) per month. For the other schools the fee is 50 francs ($9.65) per term. Students of foreign nationality who attend the school of watchmaking pay a tuition fee of 25 francs ($4.83) per month.

Students pursuing the theoretical course in electrical and mechanical engineering are required to pay a laboratory fee of 5 francs (97 cents) per term to cover the cost of materials. The tuition fee may be remitted to worthy students of limited means.

Nearly all students are insured against accidents. One-half of the premium is paid by the institution, the student's share being from 1 franc to 6 francs ($0.19 to $1.16), according to the course of studies pursued by him. Certificates are issued to students at the end of each term, and diplomas to those who at the completion of their course pass the final examination satisfactorily, provided they have attended at least three full terms at this institution.

Numerous excursions, under the guidance of the principal instructors of the institution, to various industrial establishments of Bienne and vicinity offer opportunities for practical observation in the subjects in which the students are especially interested.

The following programme gives the subjects of study pursued at this institution and the number of hours per week devoted to each.

SCHOOL OF WATCH MAKING.

This school was founded in 1872. It aims to fit students for practical work as watchmakers and to give them the theoretical instruction necessary to an intelligent comprehension of their vocation:

First year: Theory of watchmaking, 2; arithmetic, 2; algebra, 2; geometry, 2; physics, 2; chemistry, 1; technical drawing, 4; practical work, 44.

Second year: Theory of watchmaking, 2; algebra, 2; geometry, 1; cosmography, 1; physics, 2; mechanics, 2; bookkeeping, 1; drawing, 4; practical work, 44.

Third year: Theory of escapements, 3; drawing, 4; trigonometry, 1; practical work, 51.

The work in drawing embraces plane geometrical figures and projections; construction of cyclical curves; various mechanisms; catches; winding mechanisms; escapements on various scales; construction of curves for spirals; calibers.

The practical work embraces turning and filing, making small tools and such parts of watches as can be made with file and lathe, rough work, mechanisms for winding; finishing and pivoting parts, making small tools for escapements, completing an escapement model, practice in jewel setting; complete escapements, escapement models on large scale from sketches, anchor and cylinder escapements for watches, setting and regulating.

Provision has also been made for an advanced course in watchmaking, intended for those who desire to pursue studies in the higher forms of watchmaking and in electro-technics, including practical exercises in electrical and chemical operations.

There is also a special course in watch repairing requiring three years. During the first two years the students receive all the practical instruction comprised in the regular three-years' course. In the third year they receive instruction in the theory of watchmaking in its application to practice, in technical drawing, bookkeeping, foreign languages, in letter engraving, and in repairing clocks, simple and complicated watches, chronometers, and cases.

Another special course, requiring a minimum of six months, provides instruction in fitting and adjusting stem and key winders, anchors, and cylinders.

SCHOOL FOR MACHINISTS ELECTRICIANS, AND FINE INSTRUMENT MAKERS.

The department for machinists has for its object the training of engine builders, foremen of machine shops, foremen of mechanical workshops, etc. The course of instruction covers a period of six half-year terms and is as follows:

First half-year term: Arithmetic, 3; algebra, 4; geometry, 3; physics, 4; chemistry, 3; projective drawing, 6; free-hand drawing, 4; German, 3 and 4; French, 3 and 4; penmanship, 1; shopwork, 8. Optional: English, 2.

Second half-year term: Algebra, 4; geometry, 3; physics, 4; chemistry, 3; descriptive geometry, 4; machine drawing, 8; German, 2 and 4; French, 2 and 4; shopwork, 4. Optional: English, 2.

Third half-year term: Algebra, 3; geometry, 3; descriptive geometry, 3; physics, 4; mechanics, 5; theory of machinery, 4; technology, 2; strength of materials, 3; technical drawing, 8. Optional: Italian, 3.

Fourth half-year term: Algebra, 3; geometry, 3; physics, 2; mechanics, 5; hydraulics, 2; theory of machinery, 4; statics, 2; strength of materials, 2; chemistry, 1; technical drawing, 8; shopwork, 4. Optional: Italian, 2.

Fifth half-year term: Boilers and furnaces, 2; science of heat, 2; motors, 4; statics, 2; practical geometry, 4; architecture, 4; bookkeeping, 2; theory of machinery, 6; technical drawing, 16; electro-technics, 2.

Sixth half-year term: Boilers and furnaces, 2; motors, 4; estimates, 1; machine-shop management, 1; theory of machinery, 2; technical drawing, 20; geometry of motion, 2; mathematics, 2; electro-technics, 2.

The department for electricians provides a course covering a period of seven half-year terms. The studies of the first three terms are identical with the studies of the corresponding terms in the department for machinists, and are pursued simultaneously in the two departments. For the succeeding terms the programme is as follows:

Fourth half-year term: Algebra, 3; geometry, 3; physics, 2; mechanics, 5; hydraulics, 2; theory of machinery, 4; strength of materials, 2; statics, 2; technical drawing, 8; electro-technics, 3.

Fifth half-year term: Science of heat, 2; motors, 4; theory of machinery, 2; practical geometry, 4; architecture, 2; bookkeeping, 2; mathematics, 2; electro-technics, 2; magnetism and electro-magnetism, 2; chemistry, 1; technical drawing, 8; installation of electrical plants, 7; laboratory, 5. Optional: Statics, 2; lifting and transporting machines, 4; boilers and furnaces, 2.

Sixth half-year term: Motors, 4; mathematics, 2; electro-technics, 2; magnetism and electro-magnetism, 2; installation of electrical plants, 4; telegraphy, telephony, electric clocks, etc., 2; laboratory, 6–8; electrical railways, 2; technical drawing, 8; theory of electrical machines, etc., 2; chemical laboratory, 5–6; dynamos and continuous-current motors, 2.

Seventh half-year term: Mathematics, 2; installation of plants, 2; plans for electrical plants, 3; alternating-current machines and transformers, 3; laboratory, 6–8; technical drawing, 10; chemical laboratory, 5–6; special graduating work, 5.

A shorter course, requiring five half-year terms, is provided for those who do not desire to take the full theoretical course of seven terms. The instruction is mainly

of a practical character in laboratory work and in the installation of electrical plants. Applicants for admission to this course must have had at least two years' experience in electrical work.

The department for fine instrument makers is intended for makers of fine tools and machines, particularly those used in watchmaking; for makers of instruments of precision, and for makers of electrical apparatus. Pupils entering this department are required to enter into a contract of apprenticeship for the full course, covering three years. Instruction is mainly of a practical character, carried on in the mechanical workshop, supplemented by a limited amount of theoretical instruction relating to the specialty of the pupil. The theoretical subjects include arithmetic, algebra, geometry, trigonometry, physics, chemistry, bookkeeping, mechanics, drawing, technology, and theory of watchmaking. At the completion of his three years' apprenticeship the pupil takes his final examination and submits a graduating piece of work made after drawings and patterns executed by himself, and receives a certificate showing his apprenticeship and the character of the work done by him. Usually about one-third of the pupils, after completing their apprenticeship in this department, enter the department for machinists or the department for electricians.

SCHOOL OF INDUSTRIAL ARTS AND ARCHITECTURE.

This school is intended for persons who desire to qualify themselves for the positions of draftsmen, decorative painters, modelers, engravers, carvers, master builders, building contractors, master carpenters, and masons, foremen, etc. The department of industrial arts is composed of two sections, one for designing and modeling and one for chasing and engraving.

The work in the designing and modeling section covers three years, and consists of a preparatory course of one year and an advanced course of two years. The preparatory course comprises free-hand drawing, 4 hours per week; ornamental and figure drawing from models and copies, 8 hours; linear and projective drawing, 4 hours; shades and shadows, 4 hours; architectural styles, 1 hour, and architectural drawing, 4 hours. In addition, pupils devote 18 hours per week to the execution of work planned in the class room.

In the advanced course the subjects are adapted to the needs of the future occupation of the pupils. The programme of studies and hours per week are as follows:

Ornamental and figure drawing, 8; ornamental forms with exercises, 4; industrial drawing and designing, 10; perspective, 4; modeling, 13; plastics in leather, 4; architectural styles, 1; architectural drawing, 5; anatomy, 1. There is also a course in drawing from models, from figures in relief, and from nature, arranged especially for girls.

The section for chasing and engraving, which is a part of this department, aims particularly to prepare pupils for decorative and ornamental

work, especially as it relates to watchmaking. The course covers four years, according to the following programme of studies and hours per week:

First year: Free-hand drawing, 9; technical drawing, 5; ornamental forms, 5; chasing and engraving, 37.

Second year: Ornamental forms, 4; drawing from gypsum models, 5; industrial drawing, 9; architectural styles, 1; modeling, 5; anatomy, 1; chasing and engraving, 32.

Third year: Ornamental forms, 4; industrial drawing, 9; architectural styles, 1; modeling, 5; anatomy, 1; figure drawing, 5; chasing and engraving, 32.

Fourth year: Industrial drawing, 9; modeling, 9; drawing from living models, 5; chasing and engraving, 33.

The programme in the department of architecture covers a period of three years, of two terms each. The course of instruction and hours per week are as follows:

First half-year term: Arithmetic, 3; algebra, 4; plane geometry, 3; chemistry, 2; physics, 4; geometrical drawing, 6; German, 3–4; French, 3–4; penmanship, 1; architectural forms, 8; free-hand drawing, 6.

Second half-year term: German, 2–4; French, 2–4; algebra, 4; geometry, 3; physics, 4; chemistry, 2; descriptive geometry, 4; penmanship, 1; building construction, 6; architectural styles, 2; architectural drawing, 8; free-hand drawing, 4.

Third half-year term: German or French, 2; algebra, 3; trigonometry, 3; physics, 4; geology, 2; descriptive geometry, 4; mechanics, 2; building construction, 6; architectural drawing, 10; architectural styles, 2; free-hand drawing, 4; surveying and leveling, 4; penmanship, 1; modeling in wood, 2. Optional: Italian, 3.

Fourth half-year term: Descriptive geometry, 2; statics, 4; building materials, 2; perspective, 2; rural architecture, 4; building construction, 6; designing, 3; architectural drawing, 12; architectural styles, 2; ornamental drawing, 4; modeling in clay, 2; protective measures against fire, 1. Optional: Italian, 2.

Fifth half-year term: Perspective, 2; statics, 4; surveying and leveling, 4; building materials, 2; building machines, 1; building supervision and estimates, 3; building construction, 5; designing, 2; architectural drawing, 12; ornamental drawing, 4; modeling, 4; architectural styles, 2.

Sixth half-year term: Road and bridge construction, 3; earthworks and waterworks construction, 3; bookkeeping, 1; designing, 4; architectural drawing, 16; ornamental drawing, 4; modeling in clay, 4; encyclopedia of electro-technics, 2; building laws and building hygiene, 2; protective measures against accidents and emergency treatment in cases of accidents, 1.

SCHOOL FOR RAILWAY EMPLOYEES.

This school is intended to prepare young men for positions in the various departments of the railway service. The course of instruction covers a period of 2 years, and is arranged in such a manner as to offer instruction and practice along the lines of work the students intend to pursue. There are 2 courses, a general or theoretical course and a special or technical course. The time of instruction is divided about evenly between these 2 courses.

The general course comprises the following subjects and hours per week:

First year: German language, 4; French, 4; Italian, 3; geography, 3; arithmetic, 4; physics, 4; chemistry and classification of products, 2; penmanship, 2. Optional: English, 2.

Second year: German language, 3–4; French, 3–4; Italian, 2; geography, 2; arithmetic, 2. Optional: English, 2.

The technical course is as follows:

First year: Construction of railroads, 2; signal systems, 2; train service, 3; railroad laws, 2; tariffs, 2; emergency relief in cases of accidents, 1.

Second year: Construction of railroads, 2; signal systems, 2; traffic management, 5; train service, 4; railroad laws, 2; tariffs, 2; railroad correspondence, 2; telegraphy and practical exercises in preparing reports, etc., 9.

Pupils of the other schools have the privilege of attending the classes in foreign languages as provided for in this school on condition that such attendance does not conflict with their obligatory studies.

The following table shows the number of students in attendance in the different schools and departments during the year 1900:

STUDENTS ATTENDING IN THE VARIOUS SCHOOLS AND DEPARTMENTS OF THE TECHNIKUM OF WESTERN SWITZERLAND, BIENNE, 1900.

Schools and departments.	Students.
Watchmaking school	27
Department for machinists and electricians	157
Department for fine instrument makers	47
Department of industrial arts	59
Department of architecture	52
School for railway employees	124
Preparatory school	42
Total	508

The following classification of the students according to the States and countries in which they reside shows the extent to which foreigners have availed themselves of the benefits of this institution:

STUDENTS ATTENDING THE TECHNIKUM OF WESTERN SWITZERLAND, BIENNE, BY STATES AND COUNTRIES IN WHICH THEY RESIDE, 1900.

States and countries.	Students.	States and countries.	Students.
Switzerland	412	Austria	2
France	22	Roumania	2
Bulgaria	21	Egypt	1
Russia	14	Cuba	1
Germany	13	Africa	1
Italy	7	Holland	1
America	4	Poland	1
England	3		
Spain	3	Total	508

CANTONAL TECHNIKUM, BURGDORF.

The object of this school is to offer such a course of instruction of a scientific character as is indispensable to technical experts of the middle grade engaged in the handicrafts and in industrial pursuits.

The instruction given in the school is not intended to take the place of a practical workshop apprenticeship, since the training in purely manual work, such as is given in the workshops or factory, does not lie within its province. Its object is rather to give to young men such industrial knowledge and training as can not be gained in a practical apprenticeship, and the possession of which is indispensable to every one who wishes to rise above the rank of the ordinary handicraftsman. This school therefore strives to fit young persons to conduct small establishments independently, or to fill, in larger establishments, positions between that of journeyman and of engineer or architect, and for which a technical college education is required. To this end the institution is divided into three departments, namely, one for building, one for machine construction, and one for chemistry.

The department for the building trades contains (1) a section for construction work, which is intended to train students as master builders, as draftsmen and manufacturers of building materials, and as foremen of masons, carpenters, joiners, and stonecutters, and which undertakes to train them to design, draw, estimate, and execute separate constructions and architectural parts of various kinds of buildings, so that they may be capable of directing construction work and conducting the business of a building contractor; (2) a section for civil engineering work, intended to train students as general managers, road masters, weighmasters, foremen, specification writers, draftsmen, builders, and managers of gas and waterworks plants, building inspectors, etc.

The department for machinery construction, which includes electro-technics, is intended for persons wishing to become machinists, constructors, master workmen, foremen, draftsmen, house smiths, electricians, machine or tool makers, manufacturers, managers, technically trained traveling salesmen, etc. It has for its main object the training of students to prepare practical working drawings; to design simple machines and to make calculations of their construction; to judge of the usefulness, strength, and safety of single machines and groups of machines; to make calculations of weight and cost, and to do independent machinery construction work. Students who intend to make electro-technics a specialty receive, during the last two half-year terms, theoretical instruction in branches pertaining to the subject, besides training in calculating and constructing electro-technical apparatus, machines and plants, and practical work in the electro-technical and chemical laboratories.

The department of chemistry has for its purpose the training of students who wish to fit themselves as managers of establishments in which a knowledge of chemistry is essential. Students may specialize in any particular branch.

Students should have from one to three years' practical experience

either in building operations or in the workshop, according to the needs of each case. It is urgently recommended that this practical work be done before the students enter the school.

The school year is divided into a summer and a winter term. A complete course of instruction in the building trades and the machine construction departments (including electro-technics) occupies 5 half-year terms, and in the chemical department 4 half-year terms. The work of one summer term in the building trades department is repeated during the winter. This arrangement enables students who so desire, to obtain a practical experience in building work and in the workshops during the summer. The summer term begins the latter part of April and the winter term begins the first part of October.

Both regular and special students are admitted. They must be at least 15 years of age, and must pass a preliminary examination in the German and French languages, arithmetic, algebra, geometry, and geometrical and free-hand drawing.

The tuition fee is 25 francs ($4.83) per term, special students being charged 2 francs (39 cents) per weekly hour per term. Students who take chemical laboratory work must pay an additional fee of 20 francs ($3.86) per term. Students without means may be wholly or partly exempted from these payments.

At the end of each term certificates are given showing the student's work and conduct, and at the completion of the course graduation certificates are issued to those who have attended the institution three or more terms. Examinations are held at the end of each term.

The following programmes give the subjects of study pursued at this institution with the number of hours per week devoted to each:

DEPARTMENT FOR THE BUILDING TRADES.

Section for construction work.

First half-year term: German language, 4; French, 4; arithmetic, 6; algebra, 4; geometry, 3; geometrical drawing, 5; ornamental drawing, 6; penmanship, 2.

Second half-year term: German language, 3; French, 3; algebra, 4; geometry, 3; descriptive geometry, 4; physics, 3; chemistry, 3; architectural drawing, 7; building construction, 2; ornamental drawing, 4; bookkeeping, 2.

Third half-year term: Mathematics, 2; practical geometry, 2; applied descriptive geometry, 3; physics, 3; ornamental drawing, 4; ornamental modeling, 5; building construction, 11; architectural drawing, 8.

Fourth half-year term: Building mechanics, 4; building materials, 2; stonecutting, 2; building construction, 9; architectural drawing, 8; estimates and superintending of building work, 4; water and lighting arrangements, 1; ornamental drawing, 6 ornamental modeling, 3; building law, 1.

Fifth half-year term: Perspective, 2; building construction, 4; drawing plans, 15; architectural styles, 3; road construction and earthworks, 4; heating and ventilation, 2; electro-technics, 2; ornamental drawing, 4; ornamental modeling, 3.

A synopsis of the more important subjects follows:

Chemistry: Embracing general fundamental laws, metals, and bases so far as they have practical importance, and their compounds; brief introduction to the study of

organic chemistry; manufacture of gas; special studies in relation to building materials, such as lime burning, mortar, preservation of wood, artificial stone.

Architectural drawing: Drawing of architectural sections, socles, architraves, moldings, window and door frames, sections of façades, Tuscan and Doric styles; sketching profiles drawn on the blackboard by the instructor; drawing ground plans and sections from objects; copying details according to Letarouilly, façade work; detail work; drawing the façade of the school building; changing architectural drawings to different scales; copying façade sections after Letarouilly, Vignola, Mauch; drawing a window with specified floor and breast heights, with sections drawn to scale; drawing parts of the school building, the bank building, and the façade of the old town hall of Bern; transferring drawings to different scales; designing a brick dwelling house according to plans and scale; façade to details, shaded and colored; masonry and carpentry plans; details of window and roof molding in full size; design for a stable.

Building construction: Masonry work; back bondings with brick; walls of natural and artificial stone; door and window moldings; stone bonds; adhesive materials; ashlar walls; window frames. Carpentry work: Joints, truss and strut frames; strut and framework walls; joist frames; roof construction; ceiling work; various ceiling materials and their application and use; exercises in framing joists, building framework; roof supports. The building site, foundation; main and other rooms and kitchens of dwelling houses; exercises in designing small houses from specifications; the various orders. Agricultural buildings, floors, walls, and ceilings; designing of simple stables and outhouses. Wood, stone, and iron construction for complete buildings; working drawings.

Building mechanics: General mechanics; composition and resolution of forces; static factors; parallel forces; center of gravity; stability; conditions of wind pressure; application of these theories to weighted beams, simple roof construction, cranes, chimneys, church towers; theory of friction and its application to screws, spirals, and reels. Theory of resistance; strain and pressure; application of theory to calculations regarding chains, cables, walls, columns, tension; girders of wood and structural iron, beams with three supports; resistance to cracking, calculations for supporting columns of wood, cast and wrought iron.

Building materials: Natural and artificial building stones, their locality, preparation and use in building; mortar; woods and their uses; cement and asphalt; metals and their uses; glass; paints and varnishes.

Stonecutting: Arches, vaults, niches, steps; and more difficult constructions.

Estimating and superintending of building construction: General and special management of construction work; organization of the working force; wage lists; general and special building regulations; building contracts.

Water and lighting arrangements: General instructions about water supply and consumption; filtration; chemical and physical properties of water; drainage and sewerage; general gas arrangements.

Drawing plans: Design for a group of houses; dwelling houses of one and two stories; details in natural size; design of a schoolhouse for seven classes, with teacher's dwelling, drawn to a scale of 1:50.

Architectural styles: Egyptian, Persian, Greek, and Roman architecture; styles of the Italian Renaissance to the middle of the sixteenth century.

Road construction and earthworks: Explanation of maps; drawing of charts; graphical execution of a street project with scale calculations and estimates; exercises in leveling, surveying, laying out streets, etc.; measuring the building site of the savings bank; transverse and longitudinal construction of scaffolding.

Heating and ventilation: Principles of heat; fuel and its heating power; draughts; grates and chimneys; heating and cooling conditions; fireplaces and stoves of iron and porcelain; gas stoves; natural and artificial ventilation, etc.

Electro-technics: Fundamental principles of electro-technics; electric bells and lighting arrangements; accumulators, dynamos, motors, transformers and systems of distribution.

Section for civil engineering work.

First half-year term: The same as in the first term in the section for construction work.

Second half-year term: The same as in the second term in the section for construction work.

Third half-year term: Mathematics, 4; practical geometry, 2; applied descriptive geometry, 3; physics, 3; building construction, 7; machinery, 3; earthwork and similar construction, 3; drawing, 8; free-hand drawing, 4.

Fourth half-year term: Building mechanics, 4; building materials, 2; stonecutting, 2; street construction and water works, 6; wood and iron construction, 4; drawing, 12; surveying, 5; water and lighting arrangements for buildings, 1; building law, 1.

Fifth half-year term: Electro-technics, 2; heating and ventilating arrangements, 2; building construction, 4; building mechanics, 1; waterworks construction, 2; railroad construction, 6; drawing, 12; estimates, 3; improvements, 2; law, 1.

A synopsis of the more important subjects follows:

Building construction: Masonry work; stonecutting; carpentry and roofing work, ground plans for plain buildings; combined construction work in wood, stone, and iron.

Machinery: Motors, transmission and power machines.

Earthwork and similar construction: Arrangement of working sites; construction work; the kinds of soil; stratification; supporting capacity; scale calculations; building apparatus and machinery; construction of earthworks; methods of making foundations.

Drawing: Plan and design lettering; location plans in black and in color; drawing of building constructions which are used in underground construction work (stone bondings, arches, wood joints, framework, truss work, and scaffolding); dams, cuts, openings, sluices, and dikes; plain storehouses and outbuildings; problems in constructing foundations, and calculations of bearing strength; bridges of wood, stone, and iron; laying out streets; problems connected with the construction of waterworks and railroads.

Building mechanics: Composition and resolution of forces; static factors; parallel forces; center of gravity; stability; inertia; friction; simple machines; theory of resistance and its application.

Building materials: Natural and artificial building stones; woods, metals, production and use of binding materials, such as sand, lime, cement, gypsum, and mortar.

Stone cutting: Masonry and sections of masonry; vaults, steps, niches.

Street construction and waterworks: Laying out of streets; plats; length and cross-sections; roadways; construction of footpaths and sidewalks; setting out trees; street lighting; drainage; street cleaning and repairing; sewerage; gas and water conduits; estimates of cost; action of water in the soil; lining of springs; movement and pressure of water in rivers, canals, and closed conduits; water power; dike, sluice, and canal building; embankment construction; maintenance of river work; water measurements.

Wood and iron construction: Wood joints; laying of joists; truss and strut frames; lattice trusses, walls, floors, and gratings; conservation of wood; wooden bridges; rivet, screw, and wedge fastenings; iron supports and columns; connecting structural ironwork with wood and stone work; iron latticework girders; stone and iron bridges.

Surveying: Study of instruments; surveying of extended pieces of land; leveling of hilly sections; staking off circular sections; graphical execution of measurements.

Electro-technics: General principles; electric lighting and power distribution; signal arrangements; lightning-rod construction.

Heating and ventilating arrangements: Theory of heat; disposition of fireplaces, grates, and chimneys; cooking and washing arrangements; ventilation of buildings, tunnels, mines, etc.

Railroad construction: Preliminary work; foundation work; surface construction; crossings; crossing gates; tunnels; station buildings, freight and store houses; locomotive and car houses; mechanical fittings of stations; lighting; water arrangements; signals; roadway maintenance; street railways.

Estimates: Estimates for building construction work; valuations and assessments; contracts for work and for supplies.

Improvements: Causes of and remedies for swamps; removing and supplying water for land areas; drainage; systems of irrigation.

Law: Railway, street, and riparian law.

DEPARTMENT FOR MACHINERY CONSTRUCTION AND ELECTRO-TECHNICS.

Section for machinery construction.

First term: German language, 4; French, 4; arithmetic, 6; algebra, 4; geometry, 3; geometrical drawing, 5; free-hand drawing, 6; penmanship, 2.

Second term: German language, 3; French, 3; algebra, 4; geometry, 3; descriptive geometry, 4; physics, 3; chemistry, 3; drawing, 11; bookkeeping, 2.

Third term: Algebra, 5; geometry, 3; descriptive geometry, 3; physics, 4; chemistry, 3; mechanics, 4; theory of resistance, 4; construction work, 4; drawing, 10.

Fourth term: Mathematics, 5; physics, 4; mechanics, 6; graphical statics, 1; construction work, 16; drawing, 6; technology, 2.

Fifth term: Theoretical study of machinery, 6; electro-technics, 2; graphic statics, 1; construction work, 25; waterworks construction, 1; mathematics, 1; estimates, 1; factory laws, 1.

A synopsis of the more important subjects follows:

Drawing: Sketching and drawing screws, cranks, pipe joints, piston rods, etc.; drawing simple machines from sketches made by the students or from models, embracing pulleys, reels, cranes, pumps, steam cylinders, etc.; sketching and drawing machines and parts of machines, tracing and blue printing.

Mechanics: Composition and resolution of forces; static factors; conditions of equilibrium; application of these theories to levers and weighted beams; theory of center of gravity, and its application to simple and complex bodies; stability; mechanical work; volume of water; fall and power of water courses; methods of determining mechanical work; theory of friction, of the wedge, the inclined plane, the screw; axle friction of wagons and railroad coaches; rope and belt friction, application to methods of transmission; rigidity of ropes and chains and application to pulleys; dynamics of solid bodies; axioms of power, weight, and acceleration; compound motion; inclined planes; projectile motion; pendulum motion; relative motion; centric and eccentric crank motion; kinetic energy; centrifugal force; hydrostatics; vertical and lateral pressure and their application to dams; hydraulics; flow of water under constant pressure; measuring of water by complete overfall (Braschman, Weisbach, Frese), by incomplete overfall (Weisbach, Darcy, Lang); water wheels; overshot wheels; undershot and breast wheels; Poncelet wheels; turbines of various kinds; Pelton wheels; theory of hydraulic-pressure machines.

Construction work: Theory of screws and nuts, their construction, uses, and classification; theory of rivets, and particularly their uses in the construction of steam boilers; tubes and tube connections; theory and use of belts and pulleys, cogwheels, wedges, pivots, axles, supports, girders, trusses, etc.; theory of the construction of cranes, steam engines, and gas motors.

Theory of combustion: Heating, ventilation; furnaces; systems of steam heating; principal systems of steam boilers.

Technology: Production of pig iron in the blast furnace; kinds of pig iron; production of wrought iron and steel by various processes; production of cast steel; properties of wrought iron; hardening of steel; other technically important metals and alloys.

Theoretical study of machinery: Theory of heat; general study of gases and of steam; boilers and calculations relating thereto; steam engines and their parts; theory of single and double link motion; various kinds of link motion; valve motion according to Gräbner; indicated and actual power of single and compound steam engines; consumption of coal and steam; theory of fly wheels; Porter's and Hoffmann's regulators; elements of locomotive construction; relation between heating surfaces and grate area; cylinder dimensions; diameter of driving wheels; traction power; friction; number of axles; arrangement of three- and four-cylinder compound locomotives; brief study of gas and petroleum motors; the Diesel motor; tests with the 6-horse-power gas motor of the Technikum.

Electro-technics: Review of magnetism and electricity; accumulators; dynamo machines; transformers; electro motors; systems of distribution.

Waterworks construction: Experiments in water measurements; method and construction of canals; construction of dams and sluices.

Mathematics: Theory of surveying plane and elevated surfaces; exercises in leveling.

Section for electro-technics.

The work in the first, second, and third terms is the same as in the corresponding terms in the school for machinists.

Fourth half-year term: Physics, 4; mechanics, 6; construction work, 4; technology, 2; mathematics, 5; drawing, 6; electricity, 2; electro-technics, 6; construction and management of electric plants, 3; chemistry, 2.

Fifth half-year term: Mathematics, 1; mechanics, 6; construction work, 14; electro-technics, 12; chemistry, 8.

Drawing: Drawing of electro-technical apparatus and of component parts of electrical plants from models, sketches, and original designs.

A synopsis of the more important subjects follows:

Electricity: Magnetism; magnetic field of an electric current; solenoids; electromagnetism; hysteresis; magnetic induction; voltaic induction; self-induction; induction in material conductors; direct-current machines; methods of working commutators; scheme of winding for armatures and fields for bi- and multi-polar machines.

Electro-technics: The absolute mass system; measurements of resistance by various methods; universal galvanometer of Siemens & Halske; measurement of resistance to insulation of various substances; insulation of completed lighting arrangements, dynamo machines, transformers, etc.; methods of substitution; indirect determination of resistance of differential galvanometer; measuring electro-motive power; measuring the strength of currents; construction and management of electric plants; systems of current distribution; systems with storage batteries; alternating current systems with transformers; detailed designs of plants; regulation and management of the central station for light and power distribution; execution of complete designs for such plants; various technical applications of electricity; calculation of direct-current machines and motors; theory of the alternating current; self-induction and capacity of an alternating-current circuit; tension, current strength, and effect of the alternating current; theory and calculation of alternating-current transformers; polyphase currents; general study of alternating-current machines and motors; measuring of light; determination of capacities; magnetic measurements; testing of tech-

nical measuring instruments; examination of accumulators; direct and alternating current machines, transformers, and motors.

Construction and management of electric plants: The electric potential; potential difference; the electric current; resistance of conductors; Ohm's law; Kirchhoff's propositions; Joule's law; arc lamps; calculation of conductors with branching-off currents; calculation of graded conductors; closed conduction; graphical treatment of closed and open conduction; numerous practice exercises; insulation, measuring, and control apparatus; lightning safeguards; measuring instruments; registry and signal apparatus; electrometer; regulators; accumulators; exercises in designing particular plants for manufactories, dwelling houses, hotels, public buildings, etc., with separate machine plants or connected with the central station.

Construction work: The most important gearings; construction of gear wheels; installation of fixtures; complete transmission plants; iron construction work in so far as it relates to the housing of transformers and electrical conductors; construction of dynamo machines and transformers; drawing and designing of plans for electric plants.

Chemistry: Qualitative analysis with reference to materials used in electro-chemistry.

CHEMICAL DEPARTMENT.

First half-year term: The same as in the first class of the mechanical division.

Second half-year term: The same as in the second class of the mechanical division.

Third half-year term: Physics, 4; mineralogy, 1; inorganic chemistry, 5; analytical chemistry, 4; organic chemistry, 3; chemical technology, 3; laboratory, 16; mathematics, 2; machinery, 3.

Fourth half-year term: Physics, 3; organic chemistry, 5; analytical chemistry, 3; chemical technology, 4; laboratory, 16; microscopy, 1. Optional: Elements of differential and integral calculus, 2; gymnastics, 2.

A synopsis of the more important subjects follows:

Physics: Electricity; magnetism; current distribution; electrolysis; polarization; thermo-currents; magnetic fields; uses of the electro-magnet in telegraphy; Röntgen rays; general description of dynamo machines and electric motors, telephones, etc.

Inorganic chemistry: Study of the elements and their compounds.

Analytical chemistry: Qualitative analysis; experiments by the students with various gases and solids; volumetric analysis; technical examination of products.

Organic chemistry: Reactions; analytical and synthetical combinations, qualitative and quantitative analysis of elements; study of organic chemical substances; aromatic combinations; the products of dry distillation of tar and other compounds and properties.

Chemical technology: Examination of water; filtration of water for drinking and cooking purposes; necessary attributes of water for the various technical branches of industry; determining the hardness of water; production and testing of various acids and salts; production of chloride of lime; pyrite roasting; metallurgy of iron; high-furnace process, and working of crude iron; steel; wrought and cast iron; Bessemer process; dyeing of cotton, woolen, and silk goods, and the necessary apparatus and machines for these dyeing processes; bleaching; organic and inorganic mordants; dyes; fermentation.

Machinery: Classification of machines into motors, transmission and working machines; description of the machine plants at the Technikum; hydraulic and caloric motors; methods of transmission; general methods of electrical power transmission; the important tool-making machines; filter presses; centrifugal machines; pumps, etc.

Laboratory: General reactions in qualitative analysis; simple and complex analysis; examination of chemical products and raw materials; analysis of organic elements; exercises in microscopy.

The institution is managed by a board consisting of 10 members. The teaching personnel consists of a director, 12 instructors, and 6 assistant instructors. The attendance during the school year 1899–1900 was as follows:

In the department for the building trades, 115 regular and 14 special students, or a total of 129; machinery construction department, 120 regular students; electro-technical department, 45 regular students; chemical department, 12 regular students; making a total attendance of 306 students in the entire institution. Of these, 253 pupils had entirely or partly completed a practical apprenticeship before their entrance into the school.

Scholarships amounting to 1,575 francs ($304) were given to 22 students of the summer term, and 1,525 francs ($294) to 23 students of the winter term. The school received books and other contributions from the Government and from private firms and individuals.

Numerous excursions are made, under the direction of instructors, to various industrial establishments in this and other localities.

A special course in the fundamental principles of electro-technics for firemen and machinists was given Sunday afternoons for twelve weeks during the winter term, 45 persons attending this course.

Courses in the elements of differential and integral calculus and in gymnastic exercises were given as optional branches.

After the examinations held in March and August, 1899, diplomas were issued as follows: In the department for the building trades, 14; machinery construction department, 14; electro-technical department, 10; chemical department, 6; making a total of 44 graduates.

SCHOOL OF ARTS AND TRADES, FREYBURG.

This school is a part of the Industrial Museum of the Canton of Freyburg. It has two divisions—a technical school and a school for apprentices.

TECHNICAL SCHOOL.

The object of the technical school is to give to pupils, in addition to a certain amount of practical training in the various branches of industrial activity, a theoretical instruction equal to that obtained in a regular school of technology. It is composed of four distinct departments as follows: A department for machinery construction, a department for electro-technics, a department for builders, and a department for industrial art.

The department for machinery construction aims to fit pupils for positions as master mechanics, foremen of machine shops, factory superintendents, experts in the installation of machinery, mechanical draftsmen, etc. The course of instruction covers four years. The following table shows the time devoted to each subject:

COURSE OF STUDY IN THE DEPARTMENT FOR MACHINERY CONSTRUCTION, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.							
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.	Seventh term.	Eighth term.
French language	2	2						
Arithmetic	3	2						
Algebra	3	4	2	2				
Geometry	4	3	2	2				
Trigonometry		4						
Geometry, descriptive			6	2	1			
Geometry, analytical			2	3				
Physics		3	3	3				
Chemistry	2	2	2	2				
Calligraphy	1							
Drawing, free-hand	1							
Drawing, geometrical and projection	4	4						
Drawing, technical		4	4	8	12	12	10	12
Mechanics			2	2	2	2		
Calculus, differential and integral							2	3
Statics, graphical							2	
Strength of materials						3	3	
Technology				2	2			
Electro-technics					3	2		
Hydraulics							2	
Fly wheels and regulators								3
Elasticity of materials								3
Laboratory work, physics					2	2		
Laboratory work, chemistry				2	2	2		
Theory of machines						5	6	6
Estimates of work								1
Bookkeeping								1
Shopwork (optional)	20	20	20	20	20	20	20	20
Total	43	48	43	48	47	48	45	49

The department for electro-technics prepares pupils for work in the various branches of electrical work, such as designing and constructing electrical machines of different kinds, installing apparatus for electrical heating and lighting, telegraph and telephone systems, superintending work of electric light and power plants, etc. Pupils of this school follow the same course as those in the school for machinery construction during the first two years. During the remaining two years they pursue a somewhat different course, devoting special attention to work in physics and in electro-technics. The course of study is as follows:

COURSE OF STUDY IN THE DEPARTMENT FOR ELECTRO-TECHNICS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.							
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.	Seventh term.	Eighth term.
French language	2	2						
Arithmetic	3	2						
Algebra	3	4	2	2				
Geometry	4	3	2	2				
Trigonometry		4						
Geometry, descriptive			6	2	4			
Geometry, analytical			2	3				
Physics		3	3	3				
Chemistry	2	2	2	2				
Calligraphy	1							
Drawing, free-hand	4							
Drawing, geometrical and projection	4	4						
Drawing, technical		4	4	8	12	12	10	12
Mechanics			2	2	2	2		
Calculus, differential and integral							2	3
Statics, graphical							3	
Strength of materials						3	3	
Technology				2	2			

COURSE OF STUDY IN THE DEPARTMENT FOR ELECTRO-TECHNICS, SCHOOL OF ARTS AND TRADES, FREYBURG—Concluded.

Subjects.	Hours per week.							
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.	Seventh term.	Eighth term.
Electro-technics					3	4	4	5
Hydraulics							2	
Fly wheels and regulators								3
Laboratory work, physics					3	4	4	5
Laboratory work, chemistry				2	2	2	2	
Theory of machines							2	2
Estimates of work								1
Bookkeeping								1
Shopwork (optional)	20	20	20	20	20	20	20	20
Total	43	48	43	48	48	47	51	52

The department for builders provides instruction in the various branches of the building industry, such as masonry, carpentry, stone-cutting, etc. It seeks to educate pupils to a proper understanding of architecture and its relation to the work of building and construction, and to prepare them for positions as architects, construction engineers, contractors, and superintendents of construction work. The course of instruction covers a period of three and a half years, one of which is devoted entirely to practical work in the shops and yards of the school. The course of study follows:

COURSE OF STUDY IN THE DEPARTMNET FOR BUILDERS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.						
	First term.	Second term.	Third term.	Fourth term. (a)	Fifth term.	Sixth term. (a)	Seventh term.
French language	2	2					
Arithmetic	3	2					
Algebra	3	4					
Geometry	4	3	1				
Physics	3	3	3				
Chemistry	2	2					
Calligraphy	1						
Geology and mineralogy	2						
Drawing, geometrical and projection	8						
Drawing, free-hand	5	5	5		5		5
Drawing, technical		4	6		5		5
History of architecture	3	2					
Trigonometry		4					
Strength of materials		3	3				
Science of building		4	4		4		
Modeling, ornamental		4	4		4		
Chemistry, industrial			2				
Mechanics			2		2		
Technology of building materials			2				
Geometry, descriptive			6				
Geometry, practical					4		
Architecture, practical			2		2		
Statics					2		
Hydraulics					2		
Stereotomy					3		3
Shading					3		
Projections					4		10
Engineering, construction					1		2
Mathematics (review and applications)							2
Perspective, study of							4
Building laws							1
Stereotomy, applications of							4
Bookkeeping, general							2
Builder's accounts							1
Total	36	42	40		41		39

a Entire time devoted to practical work.

The department for industrial art offers to students instruction in such branches as are essential to the practice of the different industrial arts, more particularly the work of sculptors, lithographers, engravers on wood, designers, glass stainers, decorative painters, and master draftsmen. The length of the course is three years.

Below are given the subjects taught and the number of hours per week devoted to each:

COURSE OF STUDY IN THE DEPARTMENT FOR INDUSTRIAL ARTS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.					
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.
French language	2	2	.....	.....	.....	.....
Arithmetic	3	2	.....	.....	.....	.....
Chemistry	2	2	.....	.....	.....	.....
Calligraphy	1	.....	.....	.....	.....	.....
Drawing, geometrical and projection	8	.....	.....	.....	.....	.....
Drawing, free-hand	5	5	5	5	10	11
Modeling (sculptors, 12 hours per week)	4	4	4	4	4	.....
Study of styles	.....	6	6	.....	.....	.....
Shading	.....	.....	3	.....	.....	.....
Anatomy	.....	.....	.....	1	2	.....
Drawing, architectural	.....	.....	.....	5	.....	.....
Perspective	.....	.....	.....	4	.....	.....
Drawing, industrial	8	8	8	8	8	8
Drawing or shop work	23	31	30	33	32	38
Total	56	60	56	60	56	60

APPRENTICESHIP SCHOOL.

By a system of practical and theoretical instruction the apprenticeship school aims to prepare pupils for efficient work as skilled machinists, masons, stonecutters, joiners, cabinetmakers, etc. Only a limited amount of time is devoted to theoretical instruction, the pupils being employed chiefly in the performance of actual work in the shops and yards belonging to the school. The school is composed of three departments, as follows: A department for machinists, a department for stonecutters and masons, and a department for joiners and cabinetmakers.

In addition to these there is a short course in hydraulic work for those who desire to render themselves competent to plan and superintend the construction of dams and aqueducts, drainage works, roadways, etc.

In the department for machinists the pupils spend four days each week in the execution of practical work in the shops, the two remaining days being devoted to theoretical instruction. The course of study

covers four years and is apportioned according to the table shown below:

COURSE OF STUDY IN THE DEPARTMENT FOR MACHINISTS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.							
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.	Seventh term.	Eighth term.
Arithmetic	3	2						
Algebra		2	2	2				
Geometry	2	2	2	2				
Physics			3	3	3			
Chemistry				2	2	2		
Calligraphy	1							
Drawing, free-hand	4							
Drawing, geometrical and projection	4	4						
Drawing, technical		4	4	4	4	10	8	12
Mechanics					3	3	3	3
Technology				2	2			
Strength of materials							2	2
Shopwork	40	40	40	40	40	40	40	40
Study hours	4	6	7	5	4	5	5	3
Total	58	60	58	60	58	60	58	60

The course of study in the department for stonecutters and masons covers a period of two years, and is largely practical in character. Only a few hours each week during the winter months are given to theoretical work. The apprentice stonecutters devote four days per week during the two winter semesters and their entire time during the summer semester to work in the yards. The apprentice masons receive theoretical instruction during one semester only. Below is given a list of the subjects constituting the theoretical course and the number of hours per week devoted to each:

THEORETICAL COURSE OF STUDY IN THE DEPARTMENT FOR STONECUTTERS AND MASONS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.		
	First term (winter).	Second term (summer).	Third term (winter).
Arithmetic	3		2
Geometry			3
Drawing, free-hand	4		4
Drawing, geometrical	4		
Drawing, technical			6
Modeling	3	3	3
Total	14	3	18

The department for joiners and cabinetmakers aims to educate pupils for positions as masters and journeymen in the various branches of the carpentry and cabinetmaking industries. The pupils devote four days per week to practical work in the shops of the school and two days to theoretical instruction. The duration of the apprenticeship is four years.

COURSE OF STUDY IN THE DEPARTMENT FOR JOINERS AND CABINETMAKERS, SCHOOL OF ARTS AND TRADES, FREYBURG.

Subjects.	Hours per week.							
	First term.	Second term.	Third term.	Fourth term.	Fifth term.	Sixth term.	Seventh term.	Eighth term.
Arithmetic	3	2						
Geometry	2	2	2	2				
Drawing, geometrical and projection	4	4	3	4				
Drawing, free-hand	5	5	3	3	3	3	3	3
Drawing, technical			5	5	6	6	6	5
Study of forms			2	2	2	2	2	2
Modeling, ornamental					2	2	2	2
Study of industrial art styles					1	1	1	1
Estimates of work							1	1
Study of woods								1
Bookkeeping							1	1
Study hours		1	1		2	2		
Shopwork	42	46	40	44	40	44	40	44
Total	56	60	56	60	56	60	56	60

The school for hydraulic experts (*école de digueurs et draineurs*), which is annexed to the school of agriculture, but which is considered a division of the school of arts and trades, prepares pupils for the supervision and construction of dams and drainage works, aqueducts, bridges, roadways, etc. It also educates persons for positions as superintendents of cantonal and municipal roads. The theoretical course comprises six months of study, at the conclusion of which the pupils devote two months more to practice in various kinds of hydraulic and earthwork construction under the direction of competent instructors. The studies constituting the theoretical course and the number of hours per week given to each are as follows:

Course in common for drainers and constructors of dams, etc.: Geometrical drawing, 4; free-hand drawing, 4; technical drawing, 10; geology, 2; surveying and leveling, 8; bookkeeping, 1; estimates of work, etc., 5; total, 34.

Special work for drainers: General agriculture, 3; technology and drainage, 10; total hours for all studies, 47.

Special work for constructors of dams, etc.: Hydraulics, 4; study of dam construction, 2; study of plans, specifications, etc., 4; study of water-course laws, 2; study of tools and materials, 2; total for all studies, 48.

Two hours per week are devoted to instruction in gymnastics for students of all divisions who desire to take part.

Special courses are provided for persons desiring to become teachers of drawing in schools. These courses are held during the summer months of each year and comprise alternately a general course of about three months' duration in drawing and modeling as applied to the industrial arts, and a higher course, lasting about four months, in designing for architectural and machine construction work. The number of students admitted to these courses is limited to 15. These must be at least 18 years of age and are selected from among the most proficient of those who present themselves for examination. The tuition fee is 20 francs ($3.86) for each course.

A contract of apprenticeship must be entered into by those who desire admission to the apprenticeship school.

The cost of tuition to pupils of the school is as follows: Department for machinery construction and department for electro-technics, 20 francs ($3.86) per term, to pupils pursuing the theoretical course alone and 40 francs ($7.72) to those taking both the theoretical and practical branches; department for builders and department for industrial arts, 20 francs ($3.86) per term. Pupils of the apprenticeship school pay a matriculation fee of 30 francs ($5.79) on entering. The winter term begins on the first Monday in October and continues until the end of March. The summer term opens on the second Monday in April and closes about the last of July. This allows two weeks of vacation in the theoretical course at Easter and about eight weeks in August and September. There is also a vacation of one week during the Christmas holidays. Work in the shops is suspended during three days at New Year, the afternoon of Mardi gras, three days at Easter, the day following Whitsunday, and two weeks in August or September.

In the theoretical course the daily session lasts from 8 a. m. in winter and from 7 a. m. in summer until 7 p. m., with an intermission of two hours at noon, and with shorter recesses at 10 a. m. and 4 p. m.

The shopwork begins at 7 a. m. in summer and winter and continues until 6.30 p. m., with one and a half hours intermission at noon, and with short rests at 10 a. m. and 4 p. m. On Saturday evenings work is suspended at 6 o'clock.

At the end of each term public examinations are held, in which all pupils of the school are required to take part, and at which are exhibited the work executed during the term. Each pupil receives at this time a certificate showing the progress he has made in his studies. Pupils who have successfully completed the course of study in any of the divisions of the technical school are granted a diploma.

The total expense of maintaining the school in 1899 was 52,230 francs ($10,080); the subsidies received were 17,550 francs ($3,387) from the Federation, and 28,720 francs ($5,543) from other sources—communes, Canton, etc.

The number of pupils in the technical school in the year 1898–99 was 54

INDUSTRIAL ART SCHOOLS.

In selecting schools of this class for individual description, one has been taken which is devoted purely to the art industries, namely, the School of Industrial Art in Geneva, and one in which both art and other industries are taught, or the Trade and Industrial Art School in Bern. It is believed that these two schools are sufficient to give a fair idea of the nature of industrial art instruction in Switzerland.

CANTONAL SCHOOL OF INDUSTRIAL ARTS, GENEVA.

This school was founded in 1876. It is a cantonal institution, and has received a national subsidy since 1884. Its object is to give pupils a thorough training in the following branches of industrial arts: Decorative sculpturing in the building trade, molding and retouching in plaster, stone and marble sculpturing, wood carving, artistic goldsmithing, bronze work, artistic wrought-iron work, xylography, ceramics and decorative painting, and painting on enamel.

The pupils of the school are divided into two classes: Regular and special pupils. Regular pupils are those who take a complete course in any of the arts taught at the school. They are required to follow the regular programme of studies for a period of five years, and to perform all the practical work pertaining to the particular profession which they desire to enter. Special pupils are apprentices, workingmen, or other persons engaged in the arts or manufactures, who take special work at certain hours.

Following is the programme of instruction in the various classes:

Figure modeling: Application of pupil's knowledge of drawing to modeling; copying from casts of the human head in low and high relief and in the round; study of antique fragments, the masters, and molds from nature; application of the elementary principles of anatomy; copying from parts of the human body; osteology and myology; copying from groups of models in bas-relief or round boss with special reference to each pupil's occupation; making reduced or enlarged copies from plaster casts, prints, or photographs; similar exercises with modifications intended to familiarize the pupil with the principles of composition; study of anatomical proportions, draperies, and animals; styles of decorative figures; study of figures from living models; studies based on examples taken from the masters; models in round boss or bas-relief intended to be reproduced in bronze, marble, wood, etc.; retouching plaster casts; composition of industrial art objects.

Ornamental modeling: Copying from models in all styles of relief; enlargements and reductions; retouching in plaster, cut moldings and the principal ornaments as applied to architectural decoration; composition from various kinds of styles and from drawings by the masters of all ages as adapted to the particular trade or art of each pupil; retouching of plaster casts of model and mold compositions, with a view to their execution; composition of decorative groupings and pieces, and applications to the various branches of industrial art (bronze work, chasing, wood, stone, and marble sculpturing, wrought-iron work, and ceramics); flowers and leaves from nature.

Ceramics and decoration: Instruction in picture decoration as applied to ceramics; industrial drawing and painting on paper, canvas, and cloth; studies from nature (sketches and water colors); study of the different styles of ornamentation of former times; copying or arrangement of a given style by the aid of documents; exercises in decorative composition by the aid of given copies and particularly by the aid of copies made from observation or studies from nature made by the pupils; composition and decorative styles as applied to various objects and executed on different materials, such as crockery, porcelain (plates, vases, dishes, etc.), silk, screens, panels, woolen tapestries, colored cloth, and various articles on which decorative and industrial patterns are made by impressions; aquarelle and water-color painting; painting on porcelain and crockery, enamel, semivitrified crockery, crude enamel and crude clay;

the different processes of ceramic painting; knowledge of materials; the various clays and their properties, semivitrified crockery ware, metallic oxides and their derivatives, the enamels, and the materials employed in ceramic decoration; executing designs in clay or other materials used in ceramics, by the use of the potter's wheel; laboratory work in qualitative and quantitative analyses of raw materials, and in making experiments relating to the technique of ceramics.

Chasing: Study of chasing on steel, iron, bronze, and the precious metals; study of repoussé work; burin, and its relation to chasing; figures and ornaments, used in large and small pieces of jewelry, and gold and silver smithing; retouching and chasing of casts (original and remolded).

Stone and wood carving: Elementary instruction in stone and wood sculpturing; knowledge of the tools used in working on different materials, such as soft and hard stone, wood and marble; instruction in rough cutting from full-sized models; practical course relating to figures; continuation of work in carving ornaments on stone; rough-cutting figures, busts, and statuettes of stone; graded work in wood, ornamental and figure carving; decorative carving of ornaments in high relief for the decoration of buildings; carving figures and ornaments in marble; rough cutting with enlargement or reduction of the size of models; wood carving for furniture and large decorations; carving of figures and ornaments on stone, marble, and wood; execution of models made by the pupils.

Xylography: Preliminary studies; tone plates; cutting of lines, etc.; making facsimiles of pen, crayon, or water-color drawings; interpretation of drawings and of photographs taken from paintings or drawings of the masters; making wood engravings of drawings executed by the pupils.

Painting on enamel: Grinding colors; painting on clay; painting under flux; application of these processes in reproducing engravings, photographs, etc.; grinding of enamels; preparation of copper; enameling on copper; Limoges enameling; painted gold work; open-work enameling; cloisonné enameling; laid-gold work, and enameling connected with various other processes.

Artistic wrought-iron work: Practical instruction concerning the tools used in workshops for wrought-iron work; bellows, forges, drilling machines, lathes, hammers, vises, bench tools, files, etc. Study of the different kinds of iron, cast iron and steel, coals, and carbons; first elements of forging iron and steel; soldering and forge work; methods of filing; principles of adjusting, drilling and turning of iron; arrangement of tools, gravers, chisels, augers, etc.; tempering of steel; fitting and mounting; sheet-iron repoussé work, such as leaves and other objects; execution of work and of objects of art requiring exercise of the pupil's knowledge of forge, file, lathe, etc.

A course of 16 lectures on the history and the various styles of art is given during the year. Studies are also made of the different processes of molding, such as excavated molds, broken casts, etc.

The number of hours per week devoted to each branch of instruction is as follows: Course in figure drawing, 24 hours for men and 12 hours for women; architectural and perspective drawing, 12 hours; ornamental designing, 12 hours; modeling and retouching in plaster, 24 hours; ceramics and decoration, 18 hours for men and 12 hours for women; chasing, 48 hours; engraving on metal, 7 hours; stone and wood carving, 24 hours; xylography, 36 hours; painting on enamel, 24 hours; artistic wrought-iron work, 36 hours for day course and 12 hours for evening course for men; history of art and styles (16 lectures); molding in plaster, 48 hours.

The number of instructors employed in the school is 14.

In order to be admitted as regular pupils, persons must be at least 14 years of age and must have attended for two years the industrial school of Geneva or possess an equivalent education. Irregular or special pupils, before being admitted, must show that they possess the necessary knowledge and capacity for following with profit the course which they desire to pursue. The admission of all such pupils must be approved by the supervisory commission. Instruction is gratuitous, but pupils are required to furnish their own tools and all materials used in their work.

The school year begins with the first week in August and continues until the end of June. The daily sessions last from 6 a. m. in summer and from 8 a. m. in winter till 8 p. m., with one hour's intermission at noon. During the winter a course in artistic wrought-iron work is given in the evening.

The school possesses a collection of models for the use of students, a museum of industrial art objects, such as bronzes, gold work, ceramics, artistic ironwork, etc., a warehouse for the sale of articles made in the school, and a library.

TRADE AND INDUSTRIAL ART SCHOOL, BERN.

The trade school (*Handwerkerschule*) founded in 1824 by masterworkmen of Bern, and the industrial art school (*Kunstschule*) founded in 1869 by the artists' association, were merged into one school, by permission of the Federal Government, on July 5, 1899. Although the trade school was in excellent condition, and might have continued alone, the condition of affairs in the industrial art school made a change necessary because not only was there a lack of room, but an increase in its subsidy was conditioned on this change. To this end the establishment of a common course of industrial art instruction for both schools was agreed upon in September, 1898, and put into operation in the spring of 1899. The new institution enables instructors to devote themselves to individual subjects with better results.

This school has the following divisions: An industrial art school, trade courses for handicraftsmen, an industrial continuation school, and a special drawing school for teachers.

The new institution began its sessions October 1, 1899.

Candidates for admission to the industrial continuation school must have satisfied the common school requirements. Applicants for admission to the trade courses must have completed the course prescribed for the industrial continuation school. The industrial art division is intended for those who wish to prepare themselves for or are engaged in art industries. There is also an art class for amateurs. The fourth division offers a special course in drawing intended for teachers of drawing and for those who are preparing themselves as teachers. Girls are also admitted to this institution.

A tuition fee of 6 francs ($1.16) per winter term is charged in the continuation school and trade courses, and of 10 francs ($1.93) in the industrial art school. A fee of 10 francs ($1.93) is charged pupils of the industrial continuation school and the trade courses who also take the evening class of the industrial art school. Instruction in the school for drawing teachers is gratuitous. A fee of 20 francs ($3.86) per course is charged in the art classes.

The subjects taught in the industrial art school and the hours per week devoted to each are as follows:

Projection drawing, study of shading and perspective, 3; lectures and illustrations on the theory of perspective, 1; drawing figures and ornaments from plaster casts, in pencil, crayon, india ink, etc., 12; architectural drawing, 4; study of styles and orders, 4; exercises in sketching and the laws of perspective, 4; reproduction in pencil and in water colors of objects of industrial art, 3; designing, 12; drawing and designing for plastic work, 13; modeling in clay, gypsum, and wax, practical work in wood carving, leather engraving and embossing and chasing, 13; landscape and figure sketching and painting from nature (art class), 13; pencil and crayon drawing from living human models, 3; drawing and painting flowers for needlework and on porcelain, 4; history of art, 2.

In the trade courses special classes are formed for the following trades and groups of trades: Masons, stonecutters, potters, etc.; carpenters and joiners; wood model makers; cabinetmakers and wood turners; locksmiths; blacksmiths and wagon makers; tinsmiths; machinists, instrument makers, and electricians; grainers and marblers; letterers; gardeners; compositors and pressmen. The courses are as follows:

Architectural drawing (stone work): Instruction is given according to the various trades and the ability of the pupils. Masons are instructed in drawing brick bonds, details of doors and windows, socle plans and façade details according to scale; stone cutters are taught detail work of windows, doors, stairs, balconies, and pedestals according to scale, and cut-stone construction; marble workers are taught profile work of the capitals of columns, tombstone work, etc.

Architectural drawing (woodwork): Building experts, carpenters and joiners are instructed in the drawing of sections of parts of buildings and of entire buildings, and drawing in reference to roof and stair construction in wood and stone, joinery details, etc.

Modeling in wood: This includes theory of different classes of roofs, construction of stairs, sketching of models, making models of parts of roofs, towers, and stairs.

Locksmithing: This consists of a preparatory course in drawing and studying various simple objects produced in this trade, and a technical course in which instruction is given in drawing fittings for columns, supports and roofs, locks, blinds, etc., from models; and designing sections of iron windows and doors, glass roofs, etc., from specifications.

Tinsmithing: Beginners are instructed in drawing simple objects from models, such as cylinders, cones, and pyramids. Those who are farther advanced take up hexagons and octagons, cornices, oval forms, and other objects of the tinsmith's trade after specifications and models.

Graining and marbling: Exercises are given in graining and marbling first in crayon in order to learn the grains of different kinds of wood and marble, and afterwards in colors.

Machinists' trade: The instruction relates to the various kinds of screws, screw-threads and fittings, nuts and bolts; drawing simple parts of machines from models; sketching of simple machine parts and making drawings from sketches of machines and parts of machines; explanation of the gearings used in the transmission of power; drawing wall brackets, couplings, etc.; making drawings of various tools; explanation of toothed wheels and their applications; the construction of spur-toothed and conical wheels; screw and wheel movements; sketching machine tools and parts of the same; drawings from sketches.

Instrument making: Preparing classified list of materials used; construction of threads and of screws; sketching and drawing from models; drawing apparatus of various kinds, parts of machines; detail drawings of apparatus and machines.

Blacksmithing and wagon making: Study of the different parts and of the construction of wagons; drawing frames and plain bodies, with special explanation regarding the preparation and joining of wood, which is carried out partly by practical work according to scale.

Furniture designing and interior finishings: Sketching and detail drawing of pieces of furniture from models and objects; designing complete furnishings and decorations for rooms with various styles of ceilings and wainscoting.

Lettering: Copying Roman letters in various forms and styles. Decorative painting. This is almost wholly ornamental, beginners painting from simple objects and advanced pupils making their own sketches, which are then developed in technical form.

Printing: The course for compositors' apprentices covers 4 years. During the first and second years the following work is taken up: The history of the art of printing, the arrangement of a printing establishment, type and tools, grades of type, composition, imposing, and emptying forms, and all the technical details of composition, such as punctuation, spacing, sentence structure, paragraphing, tabulating, and the headings, footnotes, tables of contents, etc. During the third and fourth years the following work is taken up: Arrangement of styles, theory and practice of printing, proportion and symmetry, titular composition, such as spacing, punctuation, division of space, selection of type, etc.; various forms of printing menus, cards, programmes, etc.

The course for pressmen's apprentices embraces the following work: Color printing, including ink, rollers, paper, conditions of temperature, impression; details of producing and handling rollers, printing of illustrations of different styles, such as depressed, raised, and surface or flat printing; history of the art of wood engraving up to the present time; setting up of power arrangements; planing the blocks, various preparing methods, explanation of various technical terms; cutting out and pasting on cuts, instruction in materials used in illustration printing, paper, colors, rollers, machines; explanation of three and four color printing; producing and handling of colored plates.

Courses are also given in gardening and surveying.

Following is the course in the industrial continuation school:

Bookkeeping, business forms and arithmetic; French language, with reading, grammar, conversation and composition; German language, including grammar and penmanship; algebra and trigonometry; physics; experimental chemistry and study of materials; history and geography of Switzerland; freehand drawing, drawing from plaster casts, technical and geometrical drawing, object drawing, and perspective drawing.

The drawing school for teachers provides instruction in the following subjects:

Relief drawing from casts, drawing from nature, blackboard exercises, style, technical drawing, architectural drawing, and sketching of various objects.

The affairs of the school are directed by a commission composed of representatives of the councils of the Canton, the commune, the city, and the supervising board of the trade school.

The total number of instructors in this school is 69. The attendance on January 1, 1900, was 1,061, of whom 945 were males and 116 females. Of these pupils, 659 had a primary school education and 402 had a higher school training. The number of apprentices was 721, the number of journeymen 255, and the number of pupils in the teachers' class and those without definite occupation 85. Following is a table of the receipts and expenditures of this school for 1899 and 1900:

RECEIPTS AND EXPENDITURES OF THE TRADE AND INDUSTRIAL ART SCHOOL, BERN, 1899 AND 1900.

Items.	Trade school, 1899.	Art school, 1899.	Trade and industrial art school, 1900.
RECEIPTS.			
Contributions of the Confederation	$1,614	$1,313	$3,165
Contributions of the Canton	1,467	2,779	3,551
Contributions of the municipality	1,505	386	2,451
Contributions from corporations and private individuals	58	116	174
Interest on capital	125	77	203
Tuition fees, etc	1,448	193	1,640
Total income	6,217	4,864	11,184
EXPENDITURES.			
General administration	174	116	290
Printing and advertisements	232	154	386
Light and heat	926	309	1,235
Furniture	77	289	270
Articles used in teaching	676	97	772
Salaries	4,101	3,088	6,996
Cleaning and maintenance	97	38	135
Living models	48	97	145
Rent			270
Other articles	318	463	685
Total expenditures	6,649	4,651	11,184

TRADE SCHOOLS AND APPRENTICESHIP SHOPS.

These schools are mostly devoted to individual trades, although some, such as the building-trades and metal-working schools, teach a number of related trades. The trade schools selected for individual description are arranged alphabetically by occupations, and these are followed by a description of the municipal apprenticeship shops at Bern.

SCHOOL FOR THE BUILDING TRADES, GENEVA.

This school, known as the *École de Metiers*, owes its existence to a cantonal law passed October 19, 1895. As its name implies, the purpose of the school is to train men for the building trades. The course of instruction lasts three years, but during the last year the pupils are required to work in outside shops and yards under the supervision of the school.

The school year begins August 1 and ends July 1, and is divided into a winter and a summer term. The theoretical courses take up

from 10 to 21 hours per week and the practical courses from 28 to 45 hours per week. The theoretical instruction generally begins October 1 and ends April 1, thus allowing the rest of the year to be devoted entirely to practical work.

The school is divided into three departments, viz, one for carpentry, joinery, and cabinetmaking; one for masonry and stonecutting; and one for tinsmithing and plumbing.

The age of admission is 14 years, and candidates must pass an examination to show that they possess a sufficient degree of education. Tuition is free for Swiss citizens; foreigners pay 50 francs ($9.65) per year.

The following table shows for each department the hours per week devoted to each subject:

COURSE OF STUDY IN EACH DEPARTMENT, SCHOOL FOR THE BUILDING TRADES, GENEVA.

DEPARTMENT FOR CARPENTERS, JOINERS, AND CABINETMAKERS.

Subjects	Hours per week, summer term.			Hours per week, winter term.		
	First year.	Second year.	Third year.	First year.	Second year.	Third year.
Shopwork	44	40	a 46 c 55	28	b 27 a 29	c 40 a 35
Drawing	4	b 2 a 4	a 4	6	b 2 a 9	a 4
Building				2	b 3	
Descriptive geometry				4		
Mathematics	2			4		
French and singing	2	2	a 2	2	2	a 2
Gymnastics	3	3	a 3	3	3	b 1 a 3
Stereotomy carpentry		b 8 a 6			b 8 a 6	a 3 b 1
Physics and chemistry					b 4	
Exercises in composition						2
Industrial accounts						b 2

DEPARTMENT FOR MASONS AND STONECUTTERS.

Shopwork	44	37	d 55	28	27	c 40
Drawing	4	2		6	2	
Construction				2	3	
Descriptive geometry				1		
Mathematics	2			1		
French and singing	2	2		2	2	
Gymnastics	3	3		3	3	1
Surveying		3				
Stereotomy		8			8	1
Physics and chemistry					1	
Exercises in composition						2
Industrial accounts						2

DEPARTMENT FOR TINSMITHS AND PLUMBERS.

Shopwork	44	40	d 55	28	27	c 40
Drawing	4	2		6	2	
Construction				2	3	
Descriptive geometry				4		
Mathematics	2			1		
French and singing	2	2		2	2	
Gymnastics	3	3		3	3	1
Stereotomy		8			8	4
Physics and chemistry					4	
Exercises in composition						2
Industrial accounts						2

a For cabinetmakers.
b For carpenters and joiners.
c For carpenters and joiners; shopwork in private shops.
d Shopwork in private shops.

The course of instruction in the carpenters, joiners, and cabinetmakers' department is as follows:

First year (for all pupils): Shopwork—Study of tools and of woods, preparing woods, finishing and joining; exercises in connection with simple objects; various pieces of work made from models. All work done by the pupils is drawn in full size or to a reduced scale, either in the shop or during the drawing lessons. Drawing—Elements of sketching and free-hand drawing with special reference to the trade of the pupil. Building—Elements of the science of building; the ground, the principal materials and their uses; plans of the different parts of the building; beginning of the study of a building. Descriptive geometry—Representations of lines, surfaces, and solids in projection; simple intersections. Ornamental drawing of geometrical figures. Mathematics—Geometry, arithmetic, mensuration of surfaces and volumes; problems relating to building construction. Pupils who are not prepared in these studies review during the first months of the term. Pupils who have sufficient knowledge may be exempted from mathematics on passing an examination therein. Other subjects are French, singing, and gymnastics.

Second year (for carpenters and joiners): Shopwork—Continuation of the work of the first year; making of models relating to stereotomy; various exercises in carpentry and joinery; doors, windows, closets, stairs, iron fittings; measurements, estimating the value of work; making working drawings and drawings on a reduced scale; competitive execution by pupils of various pieces of work. Drawing—Technical drawing of plans, elevations, and sections in relation to the lessons in building construction, to objects in carpentry and joinery, to be made by the pupils; tracings; exercises in sketching. Building—Continuation of the courses of the first year; principles of statics. Carpentry—Section cutting; bevel or miter sections; working drawings; sections of slanting rafters; complete working drawings of a roof; construction of a model of the same; introduction to stonecutting; sections and intersections of cones and cylinders. Physics and chemistry—Elementary principles and their application to building materials; structure and composition of these materials, effect of atmosphere on them. French, singing, gymnastics.

Second year (for cabinetmakers): Shopwork—Joints of moldings, frames; panels, angular and curved; small pieces of ordinary furniture, of deal, and of hard wood; working drawings, plans, and sections; projections of various pieces of furniture; estimates of work done. Drawing—Technical drawing; plans; elevations and sections relating to the objects studied or executed; working sketches and outline sketches; ornamental drawing. Stereotomy—The same as that for carpenters and joiners. Other subjects are French, singing, gymnastics.

Third year (for carpenters and joiners): Work in stereotomy, composition, bookkeeping, and gymnastics occupies nine hours per week, the rest of the time being spent in private shops.

Third year (for cabinetmakers): Shopwork—Exercises in executing objects; furniture copied from the best models or designed in the school. Stereotomy—Supplementary instruction in stereotomy by the foreman of the shop; technical and construction drawing. Drawing—Knowledge of styles and application of the same to furniture. Composition, French, singing, and gymnastics.

In the masons and stonecutters' department the course of instruction is as follows:

First year: Shopwork—Study of tools, the principal kinds of building stone and other building materials; practice on sandstone, limestone, etc.; designing of panels; execution of models in plaster on a reduced scale; exercises in masonry and stone setting.

The courses in drawing, building construction, descriptive geometry, mathematics,

French, singing, and gymnastics are the same as in the first year of the section for carpenters, joiners, and cabinetmakers.

Second year: Shopwork—Continuation of the exercises of the first year. Work in cement; working drawings; calculations and estimates of work done. Surveying and leveling—field work.

The work in drawing, building construction, etc., is the same as in the section for carpenters, etc. The third year's work is also similar to that of the section for carpenters, etc.

In the tinsmiths and plumbers' department the following is the course of study:

First year: Shopwork—Tools and their uses and care; cutting, soldering, joining plane and curved surfaces. Work in zinc, tin plate, and sheet iron; designing of work to be executed, etc. The work begins with simple exercises, some of it being done by the pupils in competition with one another. The courses in drawing, construction, descriptive geometry, mathematics, French, singing, and gymnastics are the same as in the other two sections.

Second year: Shopwork—Making articles of tin plate for domestic purposes and for building work; sheet-iron work; installation of plumbing arrangements, etc.; plans and calculations of work done. The courses in drawing, construction, stereotomy, physics and chemistry, French, singing, and gymnastics are the same as in the other sections.

Third year: Stereotomy, exercises in composition, industrial bookkeeping, and gymnastics require 9 hours per week, and the balance of the week spent in private workshops.

The affairs of the school are in the hands of a board composed of 11 members. The teaching personnel consists of 7 instructors, 4 master workmen, and a dean who has immediate charge of the school.

The salaries, furniture of the school, and materials for instruction are furnished by the Government. The City of Geneva furnishes the school building, light, and heat.

TRADE SCHOOL FOR LADIES' TAILORING AND LINGERIE MAKING, ZURICH.

The object of this institution is to prepare young women for the trades of ladies' tailors, seamstresses, teachers of female manual training in the public and continuation schools, and to teach general needlework. It comprises the following departments and courses:

A trade department for ladies' tailoring; a trade department for lingerie making; a course in pattern drawing for ladies' tailors; courses in dressmaking and in plain sewing for household needs; a course for teachers of manual training; and evening courses for working women.

Each of the trade departments has a salesroom where pupils must work for at least six months. For this work they receive a compensation fixed by the school board, according to their capacity and efficiency. In order to be admitted pupils must be over 14 years of age, and must present certificates showing a general education equivalent to that obtained in a good common school or in an intermediate school, and

a knowledge and experience in female handiwork, such as is afforded by the primary schools of Zurich. Persons who have served an apprenticeship elsewhere and who wish to obtain a further training may also be admitted. The number of pupils in each class is limited, in order that proper attention may be received by each pupil.

Instruction in the two trade departments is free to residents, but foreigners must pay a tuition fee of 150 francs ($28.95). Pupils who do not take the full courses must pay the same fee. Provision is made for needy deserving pupils. The tuition fee for the special courses is from 30 to 60 francs ($5.79 to $11.58), according to the length of the period of instruction and the necessary expenses.

The school year begins May 1, instruction being given daily for 8 hours, 4 hours in the forenoon and 4 hours in the afternoon, with the exception of Saturday afternoon. The vacation period covers 4 weeks. At the close of the school term examinations and an exhibition of work done during the year are held.

The course of instruction in the department for ladies' tailoring covers from 3½ to 4 years, of which 3 years are spent in the workshop and 6 months or 1 year in the salesroom. It embraces the following work:

First year: Practical exercises—Hand and machine sewing; trimming, cutting and making underskirts, aprons and simple articles of clothing. Theoretical instruction—Measuring, designing and drawing patterns. Auxiliary subjects—German language, business forms and correspondence, 1 hour per week; geometrical and free-hand drawing, 2 hours, consisting of simple ornamental forms, drawing to various scales, exercises in designing from given patterns, coloring for use in embroidery work, and transferring designs to goods; industrial bookkeeping, 1 hour; and French language, 2 hours.

Second year: Practical exercises—Making dress-skirts (finishing, draping and trimming); finishing waists; stitching together, sewing and trimming sleeves; cutting and making blouses, morning gowns and plain dresses; repetition of the work done on skirts; altering dresses. Theoretical instruction, 2 hours per week—Measuring, designing and drawing waist patterns. Auxiliary subjects—German language, 1 hour per week; drawing, similar to that taught in the first year but of a higher grade, 2 hours; French language, 2 hours.

Third year: Practical exercises—Cutting and making ladies' and children's clothing, jackets, cloaks, etc., fitting, trimming. Theoretical instruction, 6 hours per week—Measuring, designing and drawing patterns for the above-mentioned articles; designing and drawing more difficult patterns and patterns for abnormally formed bodies. Auxiliary subjects—Domestic economy, 1 hour per week; study of costumes, styles and colors, 1 hour; during the winter, French, 2 hours.

Fourth year: Practical work in the salesroom, such as cutting, fitting, and finishing work to order.

The course of instruction in the department for lingerie work covers from 2½ to 3 years, 2 years of which are spent in the workshop and from one-half to 1 year in the salesroom. It embraces the following work:

First year: Practical exercises—Hand and machine sewing, and instruction in the use of the sewing machine, plaiting, cutting and making aprons and sleeves for the

use of the pupils, cutting and making various pieces of women's clothing, hemming and mending lingerie. Theoretical instruction, 2 hours per week—Measuring, designing, and drawing patterns for the above-mentioned articles. Auxiliary subjects—German language, 1 hour; drawing, 2 hours, embracing geometrical and free-hand drawing, such as simple ornamental styles and drawings; drawing to various scales; exercises in designing from given patterns or models, coloring for use in embroidery work, transferring designs to goods, industrial bookkeeping, 1 hour; French, 2 hours.

Second year: Practical exercises—Cutting and making underwaists, and other lingerie from measure; men's and children's linen and bed linen; cutting and making articles from models in half size. Theoretical instruction, including exercises in measuring, designing, and drawing patterns for the above-mentioned articles, and designing and drawing patterns for models in half size, 6 hours per week. Auxiliary subjects—Fundamental principles of domestic economy, 1 hour; drawing similar to that given in the first year but of a higher grade, 2 hours; French, 2 hours.

Third year: Practical work in the salesroom—Cutting and making men's linen wear, trousseaus, and children's outfits to order; ironing and plaiting. Theoretical instruction—Measuring to order, cutting and fitting, completing pattern drawings for men's and children's linen wear.

The special course in pattern drawing for tailoresses occupies 6 weeks, of 38 hours each. The work is as follows:

Designing and drawing patterns for morning gowns, various styles of waists, sleeves, gowns, jackets, etc., for normally and abnormally shaped figures; for children's clothes; for mantles, cloaks, etc.; designing of a jacket pattern from a waist pattern; designing patterns for various styles of jackets, cloaks, collars, capes, etc.; for various children's jackets, cloaks, collars, capes, etc.; designing and drawing patterns for reform and athletic costumes, gymnasium costumes, bicycle skirts, and riding habits; making half-size models in muslin; exercise in setting in various kinds of pockets in woolens.

The special course in dressmaking for home and family needs occupies 11 to 12 weeks of 38 hours each. The work is as follows:

Practical work—Exercises in hand and machine sewing with instruction in the use of sewing machines; cutting and making underskirts, underwaists, plain skirts, waists or blouses, morning jackets, morning gowns, and children's dresses; repairing and altering various articles of clothing. Theoretical instruction, 4 hours per week—Measuring, designing, and drawing patterns for underskirts, underwaists, various styles of skirts and waists for adults and children, and morning gowns. Auxiliary subjects—Free-hand drawing, stripe and ribbon ornamentation, lettering, and monograms, transferring designs to goods, 2 hours per week.

Two special courses in plain sewing for home and family needs are a day course covering 15 weeks of 36 hours each, and a half-day course covering 23 weeks of 22 to 24 hours each. These courses comprise the following subjects:

Practical work—Exercises in hand and machine sewing with instruction in the use of sewing machines; plaiting and buttonhole making; cutting and making white aprons (for the use of the pupils); cutting out and making ladies' shirts of various kinds and styles, ladies' nightgowns, drawers, undershirts, and underwaists, night jackets, morning jackets, men's shirts, and linen blouses. Theoretical instruction, 4 hours per week—Measuring, designing, and drawing patterns for the above-mentioned pieces. Auxiliary subjects—Free-hand drawing, stripe and ribbon ornamentation, lettering, and monograms, and transferring drawings to goods, 2 hours per week.

The school is under the general supervision of a board of managers consisting of 9 members, 5 of whom represent the Government and 4 the city of Zurich. Each class of the trade school and of the special courses is in charge of a teacher who is personally responsible for the conduct of her class. Each section is in charge of a section director or manager. These instructors constitute a committee which has immediate supervision over the pupils, prepares the schedules of instruction, etc.

The attendance at the end of the school term 1899–1900 was as follows: Department for ladies' tailoring, 52; department for lingerie making, 44; special courses, 175; total, 271.

Upon graduating from the school many of the pupils of the trade departments take the apprentices' examination of the Swiss Industrial Union. Of 26 graduates who took this examination in 1900 all obtained certificates. This fact can not be taken as a measure of the work done by the school, as very few pupils except the regular apprentices take this examination. The number of graduates from the department for ladies' tailoring was 14, and from the department for lingerie making 18, in 1900.

The cost of the grounds, buildings, and equipment of the school was 300,479 francs ($57,992). It is maintained by contributions from the Canton and City of Zurich, the Federal Government, and from corporations and private individuals. All private donations and legacies, unless otherwise specified, are devoted to the fund for scholarships. Materials and supplies are furnished to pupils by the school at cost price. During the school year 1899–1900 the sum of 2,000 francs ($386) was expended for scholarships for worthy pupils.

The school has a collection of models, cloths, and costumes for use in illustrating the styles and fashions of different times.

The following table shows the receipts and expenditures of the school for the calendar years 1898 and 1899:

RECEIPTS AND EXPENDITURES OF THE TRADE SCHOOL FOR LADIES' TAILORING AND LINGERIE MAKING, ZURICH, 1898 AND 1899.

Items.	1898.	1899.
RECEIPTS.		
Contributions of the Federal Government	$1,930	$2,316
Contributions of the Canton of Zurich	1,158	1,255
Contributions of the city of Zurich	1,061	1,158
Contributions of private individuals	19	.....
Tuitions	1,280	2,388
Proceeds from the sale of goods	4,875	4,294
Sale of working materials and school supplies	2,706	4,377
Interest and sundries	43	58
Balance from the previous year	307	381
Payment of a loan on the building account	531	.....
Total	13,910	16,227

RECEIPTS AND EXPENDITURES OF THE TRADE SCHOOL FOR LADIES' TAILORING AND LINGERIE MAKING, ZURICH, 1898 AND 1899—Concluded.

Items.	1898.	1899.
EXPENDITURES.		
Rent	81,144	82,277
Janitor service, light, and heat	825	787
Teachers' salaries	3,122	3,693
Laborers' wages	584	223
Furniture	1,008	506
School supplies	1,013	872
Working materials	1,176	1,737
Library	34	47
Advertisements, printing, etc	805	1,031
Scholarships	199	386
Contribution to the fund for scholarships	19	.....
Advance for new buildings	.....	1,591
Total	13,529	16,153

SCHOOL FOR MECHANICS, GENEVA.

This school was established in 1879 as a division of the school of watchmaking. In 1891 it became a separate institution, remaining, however, under the same directorate as the former school. It is a municipal institution under the control of the administrative council of the city. Its object is "to offer to mechanics a more complete theoretical knowledge than can be acquired in workshops, together with a practical training."

The administrative council is assisted in the general supervision and administration of the affairs of the school by a consulting committee, distinct from that of the watchmaking school. This committee consists of 7 members who are appointed by the administrative council for a term of 2 years. The administrative council, upon the advice of the consulting committee, appoints all officials of the school, prepares the programmes, makes all regulations, and determines the duties of each officer. The consulting committee presents each year to the administrative council a report on the progress of the school.

The theoretical course covers three years and comprises mathematics, bookkeeping, mechanics, physics, chemistry, the elements of descriptive geometry, and technical drawing in its applications to mechanics. With the exception of bookkeeping the studies are compulsory.

The practical work comprises three departments, as follows: Preparatory department—metal and wood work without the use of machinery; department of general mechanics—machine work, fitting; department of fine mechanics—instruments of precision and physical apparatus. This course also covers three years, and upon its completion pupils are qualified for admission to the superior division of the school of watchmaking. The faculty of the school consists of a director, who also has supervision over the school of watchmaking, and five assistants.

Pupils must be at least 15 years of age, and have an education equivalent to that received in the second year of the high school of Geneva.

Day pupils are not admitted to the practical work, but, on the advice of the consulting committee, they may be allowed to pursue the theoretical course.

The general expenses of the school are provided for by the city, by federal subsidies, and by tuition fees. During the year 1899 the total expenditures, as shown by the "*Jahrbuch des Unterrichtswesens in der Schweiz*," were 28,931 francs ($5,584), of which amount 9,000 francs ($1,737) were received as subsidy from the Federal Government.

The tuition fee for natives of Switzerland is 10 francs ($1.93) per month for the first year and 5 francs (97 cents) per month for the second year. During the third year tuition is free to those who have completed the first and second years' work. Those who take only the second and third years' work pay 5 francs (97 cents) per month for the two years. The tuition fee for foreigners is 25 francs ($4.83) per month for the entire course. Children of foreigners who have resided in Geneva at least ten years are admitted upon the same terms as Swiss children. The school furnishes all tools needed in the work and supplies all necessary materials.

The school year begins during the last week of July and ends about the last of June. During the first three weeks of each year the theoretical instruction is suspended and the entire time given to practical work. The average time per week devoted to theoretical instruction and drawing is, for the preparatory department, 10 hours; for the department of general mechanics, 13 hours; for the department of fine mechanics, 13 hours. The practical work consumes 57 hours per week.

SCHOOL FOR METAL WORKERS, WINTERTHUR.

This school is a cantonal institution and was annexed to the Industrial Museum of Winterthur in the spring of 1889. Its object is "to educate, by means of practical and theoretical instruction, workmen skilled in the various branches of metal work." It is placed under the control of the board of supervisors of the museum and under the immediate supervision of the director of that institution.

The school is composed of the following departments: A department for housesmiths and wrought-iron workers; a department for machinists; a department of fine mechanics; a department for pattern making and metal casting, and a course for apprentices and journeymen.

The courses of study in the first three departments are arranged to cover three years and constitute the work of the school proper. The course in the department for pattern making and metal casting covers two and a half years. Special pupils are permitted to take practical courses of instruction of one year's duration in certain branches of metal work. Such pupils are generally young persons who have already obtained, or who intend to obtain later, the necessary theoret-

ical training. The course for apprentices and journeymen is designed to offer both theoretical and practical instruction in individual branches to those who are unable to take the complete course.

The number of hours per week devoted to each study is shown in the following table:

COURSE OF STUDY IN THE SCHOOL FOR METAL WORKERS, WINTERTHUR.

Subjects.	Hours per week.		
	First year.	Second year.	Third year.
German language	2	2	
Arithmetic and algebra	2	2	1
Geometry	2	2	
Physics	2	2	
Drawing, free-hand	6	4	
Drawing, projective	6	2	
Drawing, technical		6	6
Trigonometry		1	
Technology of metals			1
Machine construction			4
Electro-technics			2
Bookkeeping			1
Study of instruments			2
Modeling			4
Shopwork	28	28	32
Total	48	49	53

The practical work is as follows:

First year: For housesmiths and machinists—Practice in handling materials; exercises at the vise, forge, and auxiliary machines; practice in forging, welding, and soldering; simple ironwork; use of tools, hammers, files, chisels, punches, etc.; simple tin work, such as folding, bending, riveting, and soldering. For instrument makers—Practice in handling of materials; exercises at the vise, lathe, and auxiliary machines; forging, soldering; use of tools; making simple tools; execution of simple work. For pattern makers—Practice in use of tools for pattern making; study of materials; exercises at the planing and turning benches.

Second year: For machinists—Practice in the production of exact mechanical work; divers manipulations. For tool and instrument makers—Execution of tools, simple electrical and physical apparatus, and instruments; polishing and enameling; use of acids, etc. For housesmiths and wrought-iron workers—Various forms of mountings; simple work in fitting; execution of divers kinds of forged work, pincers, sockets, locks, tools, etc. For pattern makers—Execution of tools for pattern making; simple patterns from drawings; exercise in hand shaping.

Third year: For machinists—Execution of tools; separate parts of machines; entire machines. For tool and instrument makers—Production of instruments and apparatus; galvano-plastic work; copper, nickel, and silver plating; general training for independent work. For housesmiths and wrought-iron workers—Ornamental mountings, locks, etc.; different kinds of more complex work, trellises, embossed and forged rosettes, leaves, and flowers; chasing, engraving, stamping, and etching. For pattern makers—Patterns and core boxes from drawings; core making in sand and clay from core boxes and models; alloying, smelting, bronze casting, etc.

The faculty of the school consists of a director, who also gives theoretical instruction, 8 instructors in theoretical branches, and 5 teachers of practical work.

Pupils must be at least 15 years of age, must prove that they have spent three years in the secondary schools of Zurich, or similar schools,

and must possess the necessary physical qualifications for beginning an apprenticeship. Regular pupils are received for a probationary period of one month.

In the first three departments mentioned above, the cost of instruction to regular pupils is 40 francs ($7.72) per year, and to special pupils 300 francs ($57.90) per year. Foreigners who enter as regular students are charged a tuition fee of 80 francs ($15.44) per year, and those taking special courses 450 francs ($86.85) per year. The rates in the school for pattern making and metal casting are 40 francs ($7.72) for regular and 150 francs ($28.95) for special pupils. Apprentices and young workmen who attend the theoretical course only, pay 3 francs (58 cents) per year for each weekly hour of instruction; those attending the practical course only, pay 6 francs ($1.16.) A matriculation fee of 10 francs ($1.93) for regular pupils and 2 francs (39 cents) for apprentices and young workmen is paid on entering the school. Partial or total remission of tuition fees is made to worthy pupils in needy circumstances.

The school is in session throughout the year, except one week in summer, one week from Christmas to New Year's day, and two weeks in April. Theoretical instruction is suspended during a few weeks in the fall.

The revenues of the school are derived from tuition fees and from cantonal and federal subsidies.

The attendance during the year 1899–1900 was 94 pupils, of whom 21 completed the course and received certificates of graduation. The total number of graduates of this institution since its organization in 1888 is 344, of whom 125 were regular and 219 special pupils.

SCHOOL OF SILK WEAVING, ZURICH.

This school was founded in 1881 by the Association for the Silk Industry (*Seidenindustrie-Gesellschaft*) of the Canton of Zurich. Its object is to prepare young men for the higher positions in the silk-weaving industry, such as superintendents of mills, and for work in the designing, arranging, and finishing departments. It is also intended to educate pupils as manufacturers and dealers in silk textiles.

The course of study covers two years and includes: History of the silk industry, study of silk culture and of raw materials, instruction in preparing the silk, theory and practical work in hand and power-loom weaving, preparing cards for Jacquard looms, study of color and of styles, free-hand and technical drawing, designing patterns, industrial bookkeeping, mathematics of weaving, and practical work on hand and power looms.

The instruction is conducted by the director, who, in addition to his supervisory work, teaches the theoretical branches of silk culture, raw materials and their preparation for weaving, bookkeeping, and mathe-

matics; a teacher of theoretical and practical work relating to hand-loom weaving; a teacher of theoretical and practical work relating to power-loom weaving, and of technical drawing; and a teacher of free-hand and pattern drawing, the preparation of cards for Jacquard looms, etc.

Pupils must be 16 years of age and have a school education sufficient to render them capable of pursuing intelligently the studies prescribed for the school, as well as a practical knowledge of the ordinary processes employed in weaving.

The cost of instruction to pupils who are natives of Switzerland is 200 francs ($38.60) for the first course and 300 francs ($57.90) for the second. Foreigners are charged 300 francs ($57.90) for the first course and 500 francs ($96.50) for the second. Free scholarships and aid funds are provided for pupils of small means who show themselves capable and industrious.

The school is in session daily, except Sundays and holidays. The winter and summer semesters are each 22 weeks in length. During the vacation period pupils have access to the school for the purpose of doing practice work.

The school is under the administration of a commission composed of seven members, of whom one is selected by the cantonal government, three by the municipal council of Zurich, and three by the Association for the Silk Industry.

The income is derived from federal, cantonal, and municipal subsidies, tuition fees, private donations, and from the treasury of the association which founded it. During the year 1899 the expenditures of the school amounted to 38,456 francs ($7,422), of which amount 8,000 francs ($1,544) were received as subsidy from the Federal Government.

SCHOOL OF WATCHMAKING, GENEVA.

This school was founded in 1824 by the Geneva Society of Arts, and continued under its direction until 1843, when its control was transferred to the city. In 1879 there was added a class in mechanics, which was detached from it in 1891 to form a separate school. The object of the school is "to give complete instruction in the art of watchmaking, so as to make able and well-informed workmen, thereby maintaining and increasing the renown of the Geneva work." It is in reality an apprenticeship school, in which an inferior course embraces three and a superior course two years of apprenticeship.

For the administration and general supervision of the school the administrative council of the city is assisted by a consulting committee of twenty members appointed by it. Of this committee three members are nominated by the chamber of commerce, three by the Watchmakers' Association, two by the Society of Arts, and the remaining

twelve by the council itself. This committee is presided over by a member delegated by the administrative council, and holds one session each month, at which a detailed report of the progress of the school is presented by the director. It has supervision over all that concerns the instruction and interior administration of the school. The administrative council, upon the advice of this committee, appoints all functionaries of the school, makes all interior regulations, prepares the programmes, and determines the duties of each officer and employee.

Instruction in the school is theoretical and practical. The theoretical course covers four years and embraces mathematics, kinematics, technical drawing, elements of physics and of chemistry, elements of astronomy, applications of electricity to watchmaking and to appliances for transmission of energy, and theory of watchmaking. These studies are in accord with the aim of the school and are compulsory. Optional branches, such as bookkeeping or others whose usefulness is apparent, may be introduced with the advice of the consulting committee.

The practical work comprises two divisions, the inferior and the superior. The inferior course comprehends successively the following work, covering in all three years: Preparatory work, rough work, mechanisms for winding, wheelwork, anchor and cylinder escapements, work by the machine process. This division includes, in addition, three classes pursuing special studies in electric clock making and in construction by the hand and the machine methods. The superior course is designed for pupils who desire to study one particular branch of watchmaking or who intend to become experts or superintendents in watch factories. It comprises the following work, covering two years: Escapements (special kinds), construction by the machine process, movements and other complicated parts, finishing and regulating, and electric clock making. In this division pupils have the liberty of choosing the class which they desire to enter. In all other respects the instruction is obligatory.

The faculty of the school consists of a director, who also gives theoretical instruction, a teacher of preparatory work, one of rough work, one of mechanisms for winding, one of wheelwork, one of escapements, one of movements, one of machine work, one of finishing and regulating, and a teacher for the class for girls.

Pupils must be at least 14 years of age and must possess an education corresponding to that received in the first year of the high school of Geneva, or, at least, must have a knowledge of arithmetic, including common fractions, the elements of algebra and of geometry, and must understand the use of the rule and the compass. Pupils of the high school who have won promotion at the end of the first year's course are admitted to the school without examination.

Workingmen desiring to perfect themselves in any one branch

taught in the school can be admitted to the superior division by special authority of the administrative council.

A class for girls was added to the school in 1895. The practical work in this class is divided into two periods of about six months each and consists in making such small tools and detached parts of watches as can be executed with the file and the lathe. The theoretical work consumes two hours per week and is in direct correlation with the practical. The daily session continues eight hours during the entire year. Pupils must be at least 13 years of age, must have completed the course in the primary school of the city, or possess an equivalent education. Pupils in this class are subject to the same regulations as apply to the classes for boys.

The expenses of the school are defrayed by the city, by federal subsidies, by tuitions, and by voluntary donations.

The tuition fee for regular pupils is fixed at 5 francs (97 cents) per month for natives of Switzerland and 25 francs ($4.83) for foreigners. The rates for special pupils are as follows: Classes in escapements and in movements, 20 francs ($3.86) per month for natives and 40 francs ($7.72) for foreigners; classes in finishing and regulating, 30 francs ($5.79) per month for natives and 50 francs ($9.65) for foreigners. Children of foreigners who have resided in Geneva at least ten years pay the same rates as Swiss children. All tuition fees are payable in advance and without deductions. Pupils in poor circumstances who prove themselves capable and industrious can secure remission of the tuition fee.

The school year comprises forty-eight weeks and begins during the last week of July, though pupils are admitted at any time during the year. The morning session lasts four hours in winter and five in summer. The afternoon session lasts five and one-half hours in winter and four and one-half hours in summer.

In the lower division pupils are furnished all tools necessary to their work, while in the higher these must be paid for by the pupils. The pupils of either division who obtain a percentage of 75 or over receive at the end of each year a certificate admitting them to the next class.

The interest arising from a bequest of 10,000 francs ($1,930) is extended as aid to deserving pupils, and that of another fund of 1,000 francs ($193) is awarded as prize money to pupils who attain distinction in their work. The total expenditures of the school for the year 1899 were 48,559 francs ($9,372). Of this amount 15,782 francs ($3,046) was received as a subsidy from the Federal Government.

SCHOOL OF WATCHMAKING, NEUCHATEL.

This school was founded in 1871 and was entirely reorganized in 1882. It is a municipal institution and, since 1885, has received a subsidy from the Federal Government. Its object is "to offer to pupils

and to workingmen in the watchmaking industry the means of acquiring the necessary theoretical knowledge, and as nearly as possible a practical training in their vocation."

A commission consisting of 13 members appointed by the municipal council of Neuchatel exercises a general supervision over the school and presents every three years to the council a detailed report showing the progress of the school during that period.

Three courses of study are provided: A scientific course, a course in theory of watchmaking and technical drawing, and a practical course.

The first or scientific course is directed in such manner as to assist the pupil to a proper comprehension of the work in the theory of watchmaking. It comprises the following studies:

Preparatory class (4 hours per week): Arithmetic. Algebra. Plane geometry. French language.

First-year class (4 hours per week): Arithmetic. Algebra. Plane geometry. French language.

Second-year class (7 hours per week): Algebra. Solid geometry. French language and commercial correspondence. Mechanics. Physics. Astronomy—General study of planetary bodies, celestial movements, laws, astronomical instruments. Electricity—Sources, effects, laws and measurement of electric currents, their application to watchmaking, classification of electric watchmaking, study of the different systems of time regulating by electricity.

Third-year class (7 hours per week): Algebra. Plane trigonometry. Descriptive geometry. Mechanics. Physics. Electricity—Electrical registering, lighting, transmission of power. Chemistry.

Special higher course for candidates for experts' diploma (7 hours per week): Calculus—Differential and integral. Analytical geometry. Mechanics. Physics. Electricity—The telephone and the telegraph. Astronomy and spherical trigonometry—Elements, astronomical coordinates (zenithal, horary, equatorial, and ecliptic); measurement of time, conversion of sidereal time into mean time, and vice versa; astronomical ephemerides; explanation and use of the "Connaissance des Temps," the "Berliner Jahrbuch," and the "Nautical Almanac;" geographical coordinates, parallaxes and astronomical refraction, effects of refraction on astral coordinates; theory of astronomical instruments, the theodolite, the meridian circle, the sextant, reflecting instruments; reckoning time, practical work at the observatory. Chemistry—Principles of metallurgy and of organic chemistry in their application to the materials used in watchmaking.

The course in theory of watchmaking and technical drawing is as follows:

First year: Theory of watchmaking (2 hours per week)—General functions of clocks and watches, the pendulum and the balance, motive forces, wheelwork, calculations and applications, calendar clocks, complicated pieces, etc. Technical drawing (4 hours per week)—Preparatory exercises, sketching small tools by free-hand and from side plans.

Second year: Theory of watchmaking (2 hours per week)—Study of gearings—determining circumference and radius of wheels and pinions, exterior and interior gearings, racks, transmission of energy by wheels, different forms of contact; geometrical study of the cycloid, the epicycloid, and the circle; gearings of mechanisms for winding, common defects in gearings; general study of escapements—general

theory of escapements, anchor and other escapements, different parts, functions and practical terminology, common defects in escapements and their remedy; measurement by aid of the goniometer and the micrometer screw, etc. Technical drawing (4 hours per week)—Drafting gearings; geometrical drawings of the different forms of anchor escapements.

Third year: Theory of watchmaking (2 hours per week)—Cylinder escapements—principal parts and their functions, practical terminology, proportions and dimensions of the principal parts; study of duplex and detent escapements, determining the dimensions of wheels, the flies of pinions, the position of the ratchet wheel and the regulator spring; old escapements, theory of regulating, inertia and angular velocity of the balance, force of the spiral, duration of oscillation, compensation, etc. Technical drawing (4 hours per week)—Drafting cylinder and other escapements, tools and machinery, Phillips' curves.

Special higher course for candidates for experts' diploma: Theory of watchmaking (2 hours per week)—Study of regulating the various influences affecting the balance, effect produced by play of pendulum spring, by friction, by the escapement, by a defect in equilibrium, etc.; adjusting to different temperatures and positions, outlines of calibers, review of the whole subject. Technical drawing (4 hours per week)—Drawing complicated pieces, repeaters, chronographs, calendar clocks, calibers of clocks and watches.

The practical work consumes, on an average, 8 hours per day and is divided into two courses. The first course covers three years and consists in preparing and setting the parts for six watches of the three calibers of the school, together with the making of the small tools used in the work. Pupils also devote a certain amount of time to work on anchor and cylinder escapements for ordinary watch movements.

The superior course is designed for candidates for an expert's diploma and can be taken only upon the completion of the first course. It consists of the construction of complicated pieces, such as chronometers, repeaters, calendar clocks, etc., and the more delicate work in adjusting, regulating, and testing. Pupils who have completed the three years' course and who are not prepared to undertake the higher work are admitted to a special course of one year's duration in watch repairing. There are also classes pursuing special studies in escapements, regulating, etc., which are open to workingmen who desire to perfect themselves in these branches.

The faculty of the school is composed of a director (who also teaches in theoretical and practical work), two instructors of practical work, four professors of scientific branches, and a teacher of electricity.

The minimum age at which pupils are admitted is 13 years.

The tuition fee for Swiss pupils, or those of foreign birth whose parents reside in Switzerland, is fixed at 15 francs ($2.90) per quarter; for foreigners it is 60 francs ($11.58) per quarter.

The school is in session from 7 a. m. in summer, and from 8 a. m. in winter, until 7 p. m., with one and one-half hours' intermission at noon. The school year comprises 48 weeks.

SCHOOL OF WATCHMAKING, SOLEURE.

This school was founded in 1884 by the Industrial Society (*Gewerbeverein*) of the city of Soleure. It is now a municipal and State institution. Its affairs are administered by a commission composed of members of the cantonal and municipal councils. Since 1885 it has been granted a subsidy by the Federal Government.

The practical work covers three years and consists, successively, of rough work, wheelwork, cylinder and anchor escapements, finishing, regulating, and testing watches. Pupils who have successfully completed the three years' apprenticeship may take a special course in watch repairing. Workingmen who desire to perfect themselves in particular branches may attend six months or a year, acccording to their previous attainments. These may take a course in only one branch if they desire.

The theoretical course is arranged as follows:

First year: Arithmetic, geometry, algebra, composition, theory of watchmaking (movements and wheelwork), and mechanics.

Second year: Arithmetic, geometry, algebra, bookkeeping (single entry), and theory of watchmaking (escapements).

Third year: Geometry, algebra, bookkeeping (double entry), and theory of watchmaking (regulating, mechanisms for winding, complicated pieces). All the pupils devote three hours per week to industrial and projection drawing.

During the winter months there is given in the evenings a public course in watchmaking open to all. This course covers a period of three years and includes wheelwork, detents, springs, escapements, mechanisms for winding, drafting calibers, complicated pieces, and adjusting and regulating.

Pupils must be 15 years of age, and must enter into a contract of apprenticeship for the full time. The faculty consists of a director and three assistants.

The tuition fee is 5 francs (97 cents) per month for Swiss children or those of foreign birth whose parents reside in Switzerland. The cost of tuition to foreigners varies from 10 francs ($1.93) to 20 francs ($3.86) per month, according to the character of the work they are pursuing. Pupils in poor circumstances who prove themselves capable and industrious can secure partial or total remission of the tuition fee.

The hours of work are arranged as follows: From March 16 to September 30, 7 a. m. to 12 m. and 1.30 to 7 p. m.; from October 1 to March 15, 8 a. m. to 12 m. and 1.30 to 7 p. m. There is a vacation of fifteen days during the summer.

Money prizes are awarded to pupils who successfully pass the examinations at the conclusion of their apprenticeship. The proceeds arising from the sale of work executed by the pupils are delivered to them at the close of the scholastic year.

In 1899 the expenditures of the school were 16,307 francs ($3,147). The Federal subsidy for this year was 2,500 francs ($483).

SCHOOL OF WATCHMAKING AND MECHANICS, CHAUX-DE-FONDS.

This school was established as a school of watchmaking in 1865. The department for mechanics was added in 1886. It is a municipal institution under the control of a board of 21 members appointed by the municipal council. Subsidies have been received from the Federal Government since 1885. Its object is to educate young men practically and theoretically in all the branches of watchmaking, and also in the construction and repair of tools and machinery used in watch manufacture.

The regular course of study covers a period of three years. Pupils who complete this course may be admitted to a higher course of one year's duration. Special studies, lasting one month or longer, may be taken by those desiring to perfect themselves in particular branches.

In the department for watchmaking the practical work comprises preliminary work in turning and filing, making small tools, rough work, wheelwork, mechanism of stemwinders, simple pieces, complicated pieces, divers escapements, finishing, mounting and adjusting, regulating and repairing.

The time per week devoted to theoretical work is apportioned as follows:

First year: Arithmetic, 2 hours; elementary geometry, 2 hours; algebra, 2 hours; metallography, 1 hour, and theory of watchmaking, 2 hours.

Second year: Elementry geometry, 1 hour; trigonometry, 1 hour; algebra, 1 hour; theory of mechanics, 2 hours; applied mechanics, 2 hours; physics, 2 hours; cosmography, 1 hour; metallography, 1 hour, and theory of watchmaking, 2 hours.

Third year: Descriptive geometry, 1 hour; algebra, 1 hour; theory of mechanics, 2 hours; applied mechanics, 2 hours; physics, 1 hour; metallography, 1 hour, and theory of watchmaking, 2 hours.

Special higher course: Analytical geometry, 1 hour; theory of mechanics, 1 hour; chemistry, 1 hour, and theory of watchmaking, 1 hour.

During the first, second, and third years 4 hours per week are devoted to technical drawing.

In the department for mechanics the practical work is as follows:

First year: Preliminary work, file work, turning, forge work, executing models for castings.

Second year: Models for castings, file work, turning, forging, setting up and adjusting apparatus for measuring, execution of simple dies and matrices.

Third year: Setting up and adjusting, executing tools used in watchmaking, also other machinery; making machines and instruments previously planned and designed by the pupil, dies and matrices, stamping.

Fourth year: Fine instruments and physical apparatus, instruments for measuring, executing machines planned and designed by the pupil.

The students in this department pursue the same theoretical course as those in the watchmaking department, except that the subjects of

cosmography and theory of watchmaking are replaced by metallography, chemistry, and applied mechanics, and six hours instead of four are devoted each week to technical drawing and sketching during the first, second, and third years.

The amount of time per week devoted to practical work in the department for watchmaking is as follows: First year, 49 hours in winter and 50 hours in summer; second year, 45 hours in winter and 46 hours in summer; third year, 50 hours in winter and 51 hours in summer; fourth or extra year, 55 hours in winter and 56 hours in summer. In the department for mechanics the number of hours per week given to practical work is smaller by two than in the corresponding classes of the watchmaking department. These two hours are devoted to mechanical drawing. The school is in session daily, except on Sundays and holidays, from 7 a. m. in summer and 8 a. m. in winter until 7 p. m., with an intermission of one and a half hours at noon.

The faculty consists of a director, who also gives instruction in theory of watchmaking and technical drawing, two instructors in theoretical branches, and five teachers of practical work, one of whom is also instructor of metallography.

The tuition fee for natives of Switzerland and pupils of foreign birth whose parents reside in Switzerland is fixed at 15 francs ($2.90) per month during the first two years of apprenticeship, 10 francs ($1.93) per month during the third year, and 5 francs (97 cents) per month during the fourth year. For foreigners the cost of tuition is 25 francs ($4.83) per month during the entire apprenticeship. Free tuition is accorded to pupils of small means.

To be admitted to the school pupils must be 14 years of age and have passed a satisfactory examination.

SCHOOL OF WATCHMAKING AND MECHANICS, SAINT IMIER.

This school was founded in 1866 as a private enterprise. It is now one of the municipal institutions of Saint Imier and has been subsidized since 1885 by the Federal Government. It maintains a department for watchmaking and one for mechanical work. The object of the watchmaking department is "to offer to young men who devote themselves to watchmaking the opportunity of serving a thorough apprenticeship and of acquiring knowledge that they can utilize in the prosecution of their vocation."

The course of study in this department covers three years and is both theoretical and practical in nature. During the first year the practical work comprises the execution of small tools for watchmaking, rough work, mechanisms for winding, finishing the wheel work for watches, and preparing the rough work for chronometers and other complicated pieces. The second year is devoted to work in anchor, cylinder, and other kinds of escapements, making and finishing the

different parts, and setting and mounting them. The third year's course includes the finishing and mounting, incasing, regulating, testing, and repairing of watches and clocks. A recent change in the programme for this year permits special attention to be given to the construction of movements for chronometers, repeaters, and other delicate timepieces. In addition to the regular course of instruction in this department there is a special course in escapements for those who desire to perfect themselves in that branch of the work.

The theoretical course in watchmaking comprises the following branches:

First year: French language. Arithmetic. Algebra. Geometry. Mechanics. Theory of watchmaking—Time and its units, description of a timepiece, motive force, calculations for wheel work, determining the diameters of wheels and pinions, study of gearings. Technical drawing—Exercises, geometrical figures, projections, sketching curves and gearings, drawing the elements of machines, free-hand drawing.

Second year: Algebra. Geometry. Mechanics. Cosmography—The earth, the solar system, terrestrial motions, measurement of time, latitude, longitude, sun dials, calendars. Theory of watchmaking—Anchor cylinder, lever, duplex, and other escapements. Technical drawing—Drawing gearings, study of wash coloring, drawing escapements, sketching tools in different positions, profiles and details.

Third year: Trigonometry. Physics—Heat, optics, electricity (applied to watchmaking). Chemistry—Principles, study of metals used in watchmaking, assaying the alloys of gold and silver. Mechanics—Practical study of the transmission of motion. Bookkeeping. Commercial arithmetic. Theory of watchmaking—Regulators, calibers, determining the excess of teeth in wheels and in pinions, etc.; review of the whole subject. Technical drawing—Drawing tools and machinery; outlines of calibers; Phillips' curves.

In the department for mechanics the practical work consists in executing simple models for castings, making small tools, such as rules, gauges, squares, drills, burins, etc.; work in soldering, hardening, grinding, chamfering, planing, and polishing; fitting and mounting machines for drilling, thread cutting, countersinking, etc. During the third year the pupils are occupied at making the stamping and shaping tools used in watchmaking, those used in constructing the movements and the more delicate parts of watches, and at the higher work in machine construction, such as completing and mounting, filing and flatting machines, lathes, dynamos, and electric motors.

The theoretical course in mechanics is arranged as follows:

First year: French language. Arithmetic. History and geography. Algebra. Geometry. Mechanics—Measurement of forces, synthesis and analysis of forces; momentum; center of gravity; simple machines. Drawing—Exercises, geometrical figures, projections, free-hand drawing from nature, drafting parts of machines.

Second year: Algebra. Geometry. Mechanics—Elements of kinematics, machines for transmitting circular motion, gearings, plans and calculations. Drawing—Drawing machinery, gearings, and devices for transmission of motion. Physics.

Third year: Trigonometry. Mechanics—Machinery for transmission of motion, elements of dynamics, centrifugal and centripetal forces, mechanical powers, strength and resistance of materials. Bookkeeping. Commercial arithmetic. Technical drawing. Physics.

The faculty of the school is composed of the director, who gives instruction in technical drawing, mechanics, and theory of watchmaking; three teachers of practical work in watchmaking; two teachers of practical work in the course for mechanics, and three instructors in scientific branches, making a total of nine persons. A commission composed of 13 members is charged with the administration and general supervision of the school and presents each year a detailed report of its progress. The examinations at the close of each year are conducted by a board of experts consisting of the federal inspector of watchmaking schools and two examiners of practical work in the watchmaking department, two in the department for mechanics, and two of theoretical work in both departments.

Pupils must be at least 14 years of age, must have finished the primary education prescribed by law, and must pass an examination for admission. The parents or guardians of children residing in the district must sign a contract of apprenticeship. Those living elsewhere must find some citizen of Saint Imier who will assume responsibility for the fulfillment of the terms of the contract. A pupil who leaves the school before the expiration of the time specified is subject to a fine, the amount of which is fixed by the commission, but which must not exceed the sum which would have been paid for tuition had the pupil remained.

The tuition fee for natives of Switzerland, or those of foreign birth whose parents reside in Switzerland, is 15 francs ($2.90) per month for the first year of apprenticeship, 10 francs ($1.93) per month for the second year, and 5 francs (97 cents) per month for the third year. Foreigners pay a matriculation fee of 100 francs ($19.30) and a monthly tuition fee of 25 francs ($4.83). Tuition for the special course in escapements is 5 francs (97 cents) per month. Partial or total remission of tuition is made to worthy pupils who are unable to pay. The work done by the pupils belongs to them, but they are encouraged to donate portions of it to the museum of the school. All tools used in their work must be furnished by the pupils, with the exception of the fixed tools and machinery which are supplied by the school.

The expenses of the school are covered by federal and cantonal subsidies, municipal appropriations, tuitions, interest on the capital of the school, and by voluntary donations. The receipts and expenditures for the year 1899 were as follows:

Receipts:	
Federal subsidy	$1,891
Cantonal subsidy	1,737
Municipal appropriation	1,303
Tuition fees	620
Donations	908
Receipts for testing timepieces	327
Tools and materials sold to pupils	148

Receipts—Concluded.	
Sundries	$488
Interest on special funds	28
Total receipts	7,450
Expenditures:	
Salaries of director and teachers	3,960
Rent, lighting, heating, etc	587
Tools	104
Physical apparatus	105
Library	40
Bureau for testing timepieces	122
Museum	3
Materials for instruction	53
Tools and materials for pupils	221
Rent, tools, materials, etc., for department of mechanics	1,724
Sundries	414
Balance applied to loan fund	117
Total expenditures	7,450

An inventory of the assets of the school, taken December 31, 1899, showed the following values:

Halls for theoretical instruction	$400
Library	513
Materials for instruction	1,277
Museum	890
Workshops for watchmakers	2,539
Workshops for mechanics	4,797
Materials for work in mechanics' department	291
Tools and materials in warehouse	434
Bureau for testing timepieces	293
Loan fund	1,179
Building fund	4,302
Total assets	16,915

The school is in session daily, except Sundays and holidays, from 7 a. m. to 6 p. m. in summer, and from 8 a. m. to 7 p. m. in winter, with an intermission of one hour at noon. There is no vacation.

The maximum attendance during the year 1899–1900 was 48 pupils, distributed as follows: Department of watchmaking—first-year class, 12 pupils; second-year class, 9 pupils; third-year class, 8 pupils; special class in escapements, 4 pupils. Department of mechanics—first-year class, 9 pupils; second-year class, 4 pupils; third-year class, 2 pupils. At the beginning of the new year, May 1, 1900, there were 52 pupils in attendance.

SCHOOL OF WEAVING, WATTWYL.

This school was founded by the Weaving School Association (*Webschulgenossenschaft*), a branch of the Cantonal Society for the

Advancement of Public Utility of Saint Gall, and was formally opened May 16, 1881. The object of the school is to supply to the weaving industry artisans specially skilled in the manufacture of the various kinds of cotton, linen, and woolen textiles; mill superintendents and overseers possessing a thorough knowledge of all the details of practical work, both on hand and power looms, and, in addition, to afford young men devoting themselves to the mercantile branches of the industry an opportunity of acquiring a knowledge of materials and products and other information useful to them in the conduct of their business.

The course of instruction is for one year, and comprises all the details of weaving plain goods, coarse, fine, and complicated patterns, upholstering materials, towelings, etc., on the hand and power looms; performing the preparatory work on the looms, examining and finishing the goods, etc. This work is performed during four hours in the afternoon.

Theoretical instruction is given in the forenoon of each day and includes technical drawing, designing patterns, preparing cards from copy, from goods, and from original compositions, and mathematics of weaving.

The general administration of the affairs of the school is intrusted to a board of directors named by the weaving school commission, which in its turn designates a supervisory committee charged directly with the management of matters pertaining to the school's welfare and progress. Instruction is given by the director and one assistant.

The school derives its income from cantonal and federal subsidies, tuitions, private donations, and from the treasury of the society which controls it. During the year 1899 the total expenses of the school were 18,981 francs ($3,663), of which 5,000 francs ($965), was received as a subsidy from the Federal Government.

Pupils must be 15 years of age and have completed the course prescribed by law for primary schools, or 14 years of age and have taken two courses in the high school (*Realschule*).

The annual cost of instruction to each pupil is 100 francs ($19.30) for natives of Switzerland, and 300 francs ($57.90) for foreigners. Free tuition and aid funds are provided for pupils in poor circumstances who show themselves capable and industrious. Pupils are supplied with all materials, and all articles made by them become the property of the school.

SCHOOL OF WOOD CARVING, BRIENZ.

This school was established in 1884 as a substitute for the School of Drawing and Modeling (*Zeichen- und Modellierschule*), founded by the Society for the Advancement of Public Utility of Brienz in 1862. It is a municipal institution for the training of young men for the wood-

carving industry. It also aims to assist local wood carvers in their work by offering them free access to its collection of books and models and by giving them practical advice.

The regular course of instruction covers four years, and comprises free-hand and technical drawing, study of styles of ornamentation, modeling, and wood carving. Besides the usual styles of ornamentation, special attention is given to those styles that are peculiar to Switzerland, such as Alpine plants and animals, for which there is always a great demand.

The hours of work per week are arranged as follows: Free-hand drawing, 7; technical drawing, 2½; study of styles of ornamentation, 2½; modeling, 7; wood carving, from 35 to 40.

The course in wood carving is divided into elementary work in the first half-year term, special work in animal and ornamental carving in the second term, and the making of objects to be offered for sale during the second, third, and fourth years.

During the winter months there is a special evening course in drawing for adults and boys who can not attend the day school. The course for adults lasts from the middle of November until the end of March and comprises free-hand and technical drawing for various trades. Six hours per week are devoted to this work. In the course for boys 7½ hours per week are devoted to instruction in elementary free-hand drawing.

The minimum age at which persons are admitted to the drawing classes is 16 years for those pursuing the course for adults and 8 years for pupils of the class for boys.

Pupils of the wood-carving school are received for a probationary period of three months. They must be between the ages of 16 and 25 years and must enter into a contract of apprenticeship.

Instruction in the school is gratuitous, but pupils are charged a matriculation fee of 10 francs ($1.93) on entering to cover cost of materials, and are required to deposit 50 francs ($9.65) as security for serving out their entire apprenticeship. After the first year they are allowed one-half of the proceeds from the sale of articles made by them.

The school is in session daily, except Sundays and holidays, during 26 weeks in winter and 22 weeks in summer.

The teaching personnel consists of a director, who is instructor of technical drawing and styles of ornamentation; a teacher of free-hand drawing and modeling, a teacher of ornamental carving, a teacher of animal carving, and one assistant.

The affairs of the school are administered by a committee of ten persons appointed by the municipal council of Brienz. Its income is derived from the sale of articles made in the school, from church contributions, and from federal and municipal appropriations. During

the year 1899 the federal subsidy was 5,400 francs ($1,042) and the amount received from other sources was 11,000 francs ($2,123).

The school possesses a collection of models, a library, and a geological park in which are kept a number of animals of different kinds for study by pupils who are making a specialty of animal carving.

The attendance upon the school during the year 1898–99 was 161 pupils, divided as follows: School of wood carving, 23 apprentices; special drawing course for adults, 48 pupils; school of drawing for boys, 90 pupils.

APPRENTICESHIP SHOPS, BERN.

This school was established in the spring of 1888. It is a municipal institution, under the direction of a board of supervisors appointed by the municipal council. At the time of organization it comprised two departments—carpentry and shoemaking. In 1894 there was added a department for metal workers (locksmiths and tinsmiths). In 1900 the department of shoemaking was discontinued because of lack of students.

The object of the school, as embodied in a resolution of the municipal council, is "to enable young persons leaving school thoroughly to learn some useful trade; to meet the increasing efficiency of foreign labor by placing domestic labor on a higher plane; to elevate skilled labor in general by giving to workingmen a thorough training in the theoretical, artistic, and practical features of their work; and further, to investigate and place before the members of the various trades the results of the latest industrial improvements."

The course of instruction in the division for carpenters is as follows:

First year: Arithmetic. Geometry. Technical drawing—Drawing wood joints and such work as the pupils execute in the shop. Workshop instruction—Practice in planing, sawing, dovetailing, chiseling, slitting, making models of the various wood joints, making simple pieces of furniture.

Second year: Arithmetic—Explanation of the calculations used in the various technical operations; estimates of costs from workshop plans. Stereotomy—Calculating the surface and contents of bodies. Technical drawing—Exercises in sketching furniture in plans and in perspective. Free-hand drawing—Ornamental drawing and shading. Workshop instruction—Beginning hard-wood work of large size, mainly chairs and chest furniture of oak; building work.

Third year: Bookkeeping—Purpose, arrangement and keeping of the necessary books of an establishment; brief explanation of bills of exchange, bankruptcy proceedings, etc. Technical drawing—Application of architectural forms; designing sets of furniture and arrangement of rooms. Free-hand drawing—Colored relief work and plastic ornament drawing. Workshop instruction—Work in plain and polished walnut.

In the divisions for locksmiths and tinsmiths the work in arithmetic, geometry, and bookkeeping is practically the same as that just described. The work in drawing is adapted to the needs of each trade.

The shopwork for locksmiths is as follows:

First year: Exercises in filing, chiseling, simple sheet-iron work, such as ventilators, stove doors, etc. The forge work consists of making cramp irons, chisels, drills, etc.

Second year: Work on building iron, and simple scroll work; chiseling out, filing and welding of leaves, flowers, etc.; making bolt locks.

Third year: Forging industrial art objects; executing window and door lattice work in iron; railings, etc., for stairs.

The work for tinsmiths is as follows:

First year: Making simple household utensils; exercises in cutting, laying in of wire, rounding, soldering, drawing-in, chamfering, etc.

Second year: Work in sheet tin, zinc, and copper; use of the machines; hard soldering.

Third year: Making bath tubs of various kinds; gas water-heating devices for bath tubs; building work executed in the shop; two months' work in actual building operations; zinc ornaments; use of stamping machines, etc.

The theoretical work takes from 8 to 11 hours per week, while the shopwork takes from 46 to 50 hours per week.

The faculty consists of a director, who also gives instruction, and 15 instructors. The number of students on January 1, 1900, was 89.

The school is in session daily, except Sundays and holidays, from 7 a. m. to 6 p. m., with 1½ hours' intermission at noon. There is a vacation of one week during the Christmas holidays. In summer theoretical instruction is suspended during four weeks in the carpentry and metal-working departments and the entire time devoted to practical work in the shops.

This school receives all young men who have completed the term in the public schools prescribed by law and who possess the requisite health and mental fitness for beginning an apprenticeship. These must enter into a contract of apprenticeship for the full term of three years. All instruction is free. Dinner is furnished at noon at the expense of the institution. Arrangements are made by which pupils who do not reside in the city can obtain board at reduced prices.

After six months of apprenticeship the pupils receive a money compensation for work executed within a specified time. The amount of this compensation is determined by a tariff, which assigns to each article a sum to be paid for its completion before the expiration of a set time. The work in order to be accepted must be of a certain degree of excellence. This system is considered a very important feature of the shopwork, as it has been found that since its introduction pupils work with greater zeal and willingness than before. All are anxious to make their first earnings in life as great as possible, and, as a consequence, they work to their full capacity.

In 1899 the amount of federal subsidy accruing was 21,900 francs ($4,227). The total expenditures of the school for the same year were 137,257 francs ($26,491).

HOUSEKEEPING AND DOMESTIC SERVICE SCHOOLS.

The only schools of this class within the scope of the present report are those which train domestic servants. The school at Lenzburg, which is described in detail, is probably one of the best of its kind in Switzerland.

SCHOOL FOR HOUSEKEEPERS AND SERVANTS, LENZBURG.

The school for housekeepers and servants at Lenzburg, in the Canton of Aargau, was founded in 1889 by the Swiss Women's Society for Public Utility. It is a boarding school with a course lasting three months. The instruction includes both theoretical and practical work in all subjects connected with housekeeping and cooking.

The practical work is as follows:

Cooking and baking, with special attention to the meats, vegetables, and fruits used in ordinary households; bread baking; preparation of confectionery and pastry; preparation of conserves and of candied fruits and vegetables; needlework; sewing by hand, with the machine, mending, knitting, embroidery, etc.; washing and ironing; gardening and the growing of vegetables. The pupils also do all the ordinary work of housekeeping, such as making beds, putting rooms in order, sweeping, etc.

The theoretical work of the school covers:

Domestic economy; theory of nutrition; discussion of recipes for cooking; single-entry bookkeeping; expense accounts; hygiene.

The female director of the school gives the instruction in the theoretical and practical branches, with the exception of needlework, for which a special teacher comes to the school once a week.

Only 12 pupils are received each term. They must be at least 16 years of age and in good health. The cost of tuition, board, and lodging is 70 francs ($13.51) for the three months. Philanthropic societies are given a reduced rate for pupils whom they send to the school. Reductions are also made for able and industrious young persons who can not afford to pay the regular fee.

The salary of the directress is 800 to 1,000 francs ($154 to $193) per year, and in addition she receives board and lodging. The total expense of conducting the school ranges from 8,000 to 10,000 francs ($1,544 to $1,930) annually. In 1900 the federal subsidy amounted to 1,000 francs ($193).

The results of the school are considered satisfactory. In 1900 the number of pupils who were given diplomas was 43. Most of the graduates of the school have good positions and are rendering satisfactory service to their employers. In spite of this fact those in charge of the school claim that the period of instruction is too short. The directress of the school also states that the brightest and most adaptable girls prefer to take up other work than domestic service.

The result is that those who come to the school are more difficult to educate than persons attending other classes of schools. For these reasons a longer school term than three months is being advocated in Lenzburg, and as a matter of fact has been adopted by similar schools in other localities. In Boniswyl the term is five months, while in Bern it is six months.

INDUSTRIAL CONTINUATION AND HANDICRAFT SCHOOLS AND TRADE COURSES.

In Switzerland the industrial continuation schools and special trade courses so closely resemble those of other countries that they need not be described in detail. The two handicraft schools described below are fairly representative of that class of schools in Switzerland.

HANDICRAFT SCHOOL, BURGDORF.

The object of this school is to offer a course of instruction of a theoretical character, combined as far as necessary with practical exercises, in those branches which are indispensable to persons engaged in the intermediate grade of industrial pursuits.

The course of instruction is divided into two terms—a summer term beginning in April and ending the latter part of September, and a winter term beginning in October and ending in March. Instruction during the winter term is given on week days from 8 to 9.30 p. m., and on Sundays from 9 to 11.30 a. m. During the summer term the instruction is irregular, being usually given on evenings and on Sunday mornings. The subjects taught are as follows:

Summer term: In free-hand drawing beginners are taught the elements of surface ornamentation with special reference to leaf forms, while advanced pupils are taught perspective drawing of round bodies and colored surface ornamentation. In technical drawing instruction is given in simple technical lettering, drawing plans and sections of simple bodies from models, drawing bodies in various positions, etc.; screw lines and surfaces and exercises in sketching.

Winter term: In free-hand drawing beginners are taught the elements of surface ornamentation, and linear perspective with practical application to models; advanced pupils are taught to draw and paint surface ornaments, and to shade in crayon and in colors. In technical drawing instruction is given in the use and handling of drawing instruments, measurement of angles, measurement of polygons, ellipses and circles, ordinary ornamentation; views of doors, windows, chests, etc., from designs; exercises in sketching, calculations of surfaces, bodies, and weight generally in connection with drawing exercises. In physics instruction is given in the principles of mechanics and electricity, currents, induction, telephones and telegraphs, lighting, motors, etc. Instruction is also given in arithmetic, bookkeeping, German language, and history and geography of Switzerland.

This school is managed by a board of nine persons, all of whom are engaged in various industries. The teaching personnel consists of the director and nine instructors.

A tuition fee of 2 francs (39 cents) is charged for the summer course, and 5 francs (97 cents) for the winter course. Needy pupils may be exempted from these payments.

The attendance at the summer course of 1899 was 42, and at the winter course of 1899–1900 it was 115.

Following is a table showing the receipts and expenditures for the year 1899–1900:

RECEIPTS AND EXPENDITURES OF THE HANDICRAFT SCHOOL, BURGDORF, 1899–1900.

Receipts.		Expenditures.	
Items.	Amount.	Items.	Amount.
Balance from previous year	$15	Salaries	$576
Tuitions and fines	97	Heat and rent	135
Contribution of the Public Utility Society of Burgdorf	58	Lighting	50
		School supplies	75
Contribution of the Handicrafts' Association of Burgdorf	15	Teaching materials	26
		Furniture	24
Contribution of the municipality of Burgdorf	270	Excursion to Bern	19
		Printing and advertisements	20
Contribution of the Canton of Bern	193	Repairs	4
Contribution of the Federal Government	270	Freight, etc	3
		Other items	6
Interest	23	Total	938
Total	941		

TRADES ACADEMY, GENEVA.

The object of this school is to give to working men and women, during their leisure hours, such instruction as will better fit them for successful work in their respective occupations. It is supported by the city and by federal subsidies. The total expenditures for 1899 were 31,882 francs ($6,153), of which 8,000 francs ($1,544) were received from the Federal Government.

The division for men was founded in 1883. Pupils must be at least 16 years of age and must possess the educational qualifications necessary to a proper comprehension of the work. The cost of instruction to each pupil is 1 franc (19 cents) per course.

The courses of study comprise a general course for builders, lasting two years; a course for tinsmiths, zinc workers, etc., lasting two years; a three-years' course for upholsterers, a three-years' course in draping, a four-years' course in furniture ornamenting, a practical course for shoemakers, and courses for jewelers, chain makers, and tailors.

The division for women was founded in 1885 and consists of two departments. The first is in session only on week-day evenings, from 8 to 9.30 o'clock, and is composed of young seamstresses, needlewomen, commercial employees, etc., who desire instruction suited to their several vocations.

The course of study comprises cutting ladies' garments, cutting garments for children, cutting underwear, mending, embroidery

designing, millinery work, cleaning and ironing, each branch two lessons of 1½ hours per week; machine sewing, one lesson of 1½ hours; bookkeeping and calligraphy, two lessons of 1½ hours each.

The second department is intended chiefly for persons without gainful occupations and its aim is to give them such training in household and domestic economy as will enable them to secure positions in the service of families. Instruction in this department is given only during the day and comprises two lessons of 2 hours each per week.

The school year embraces 7 months and is divided into two terms, from October 2 to December 22 and from January 8 to April 30.

A special course in garment cutting is arranged for apprentices of less than 16 years of age. Its aim is to give theoretical instruction in keeping with the practical work executed in the shops. These lessons are free and occur on Monday of each week throughout the year, from 7 to 9 a. m. in summer and from 8 to 10 a. m. in winter.

There is, in addition, a practical course in cutting and making ladies' garments. This course consumes 5 days per week, from 8 a. m. to noon, and from 1.45 to 6 p. m., and comprises three terms of 3 months each.

The cost of instruction in the several departments is as follows: For the evening classes, 1 franc (19 cents) per term; for the day courses, 3 francs (58 cents) per term; for the practical course in garment making for ladies, 15 francs ($2.90) per term. All necessary materials and supplies are furnished free. Pupils must be at least 14 years of age for the day school and 16 years for the evening courses.

ATTITUDE OF EDUCATORS, EMPLOYERS, GRADUATES OF TRADE AND TECHNICAL SCHOOLS, AND LABOR UNIONS TOWARD TRADE AND TECHNICAL EDUCATION.

ATTITUDE OF EDUCATORS.

The secretary of the Swiss federal department of industry, speaking with reference to trade education generally in Switzerland, stated that "the courses in all the schools are made as nearly perfect as possible, and are changed from year to year as local conditions may require." While specific data as to the benefits accruing from these schools could not be produced, he stated without qualification that their influence "has been good, and that they have improved the efficiency of the workmen." This official knew of no case of a labor union opposing trade schools. On the contrary, he said, they were always in favor of such schools, and even themselves organized courses for workmen. The need for this action, however, becomes less as new schools are founded by the Government. Since the trade schools receive State subsidies, they do not need pecuniary aid from the labor unions. The development of these schools during the last 15 years,

as shown by the enormous increase in their expenditures and the corresponding increase in the subsidies granted to them, argues their success in preparing workingmen for the trades. He stated that while the question of graduates obtaining better wages is largely one governed by business conditions and the state of the labor market, they do obtain better positions and probably advance more rapidly than those who have not had technical instruction.

Although it can not be said that any new industry has been created by the operation of trade schools—such an occurrence being very rare in Switzerland—certain old industries have been favorably affected. Through the schools for wood carving that industry has been largely developed. Another important industry developed in like manner is machine embroidery, the products of which are largely exported to the United States.

It is becoming more and more the practice in Switzerland, especially in small establishments, to do away with the old apprentice system and employ only men who have taken a course at a trade or apprenticeship school. Some large establishments have adopted the same rule. The founding of the apprenticeship shops (*Lehrwerkstätten*) had as its main object to supply this increasing demand for ready-made workmen. At the same time the success of these schools has caused an improvement in the ordinary shop training. It is, in general, possible for the graduate of a trade or technical school in Switzerland to practice his trade without a term of apprenticeship; but he must in every case go through a short form of apprenticeship merely to get accustomed to the conditions, etc.

In general, the official quoted is of the opinion that the trade and technical schools of Switzerland have fully realized the aims for which they were established.

The chief clerk of the department of public instruction and worship, Canton of Vaud, furnished observations respecting trade schools generally in Switzerland. The Canton of Vaud, mainly agricultural, has few manufacturing industries of importance and no special trade schools, except small local courses. He stated that not only have the Swiss schools been recognized by the labor unions, but the latter are always in favor of them. In many instances courses have been organized on a small scale by committees of the unions. These are supported partly by the unions, partly by the communes, and partly by the State.

The graduates of the trade schools, he believes, can obtain better wages, advance more rapidly and reach higher positions than those who have merely a shop training, because they are better fitted by their systematic training in the schools to adapt themselves to the conditions in any workshop. They are also more independent, and if a place does not suit a graduate he can leave it with a better chance of

getting another. Employers prefer graduates of trade and technical schools to apprentices and workmen with only a shop training. Regarding the causal relation between the development of industries on the one hand and the establishment of trade schools on the other, he thinks the influence may be in either direction. It is hard to ascertain a predominance either way.

A school inspector of the city of Bern stated, regarding trade schools in that city, that their courses of study "are altered from year to year as the need may be felt, so that at all times they are as nearly perfect as we know how to make them." The schools have improved the workmanship and the quality of products, undoubtedly tending to increase the intelligence and efficiency of the working classes. Specific evidence of the beneficial effect of the schools is found in their continual increase in size and number and in the generous subsidies granted them by the Government. The labor unions are friendly, have never been otherwise, and recognizing their value, are working in harmony with them. Graduates generally get higher wages, steadier employment, etc., because of their school training. They are preferred by employers "because they are better and more scientifically trained than those who have learned their trade entirely by apprenticeship." The schools have had the effect of diminishing the number of youths who learn their trade by apprenticeship. In some trades it is possible for a graduate to work without passing through a period of apprenticeship. Regarding the relation of the schools to industrial development, no precise statement could be made, "as it is seldom possible to say whether the development or revolution of an industry is due directly to the schools or to other causes in connection with them. Leather working and wood carving, at all events, are industries which owe their development largely to the schools."

The director of primary and technical education in Geneva and president of the supervising committee of the school for the building trades in that city, finds nothing faulty or defective in the courses of study of these institutions. They have, he states, been recognized and favored by labor unions generally in Geneva. There has been noticeable, however, a certain undercurrent of opposition on the part of some of the members of the unions—an opposition entirely personal and never openly expressed. It may be attributed to the fear of being displaced by the better-trained graduates of the trade schools. At the time of founding the school for the building trades he took counsel of a commission of six manufacturers and six workingmen. The manufacturers were distinctly in favor of founding the school, because it would furnish them with systematically trained men, whereas, under the existing régime, when they had to train the apprentices themselves, about a year was practically lost in getting them started. The workingmen, as representatives of unions, were also in favor of the school,

though some may have been opposed personally, as before stated. The unions had never opposed the schools.

There is no doubt, he thinks, that graduates of these schools obtain better places, higher wages, etc., than merely shop-trained men, though perhaps not at first. The apprentice, working in the shop of the school, obtains a good general idea of the different processes in his trade, besides the theoretical knowledge. But at first he is not able to compete with the shop-trained workman because of lack of practice in the details and the special processes used in the shop. After six months or a year, however, he has mastered these details, and is in every way a better workman than the other man and capable of filling a more responsible position. The trade-school graduates are preferred by employers in Geneva, because they are trained more systematically, are better qualified to take responsible positions, and require a shorter period of apprenticeship. Graduates always have to undergo a certain apprenticeship in order to become accustomed to the particular methods of the shop. At the same time the success of the schools has caused an improvement in the ordinary shop training given in Geneva. They have also stimulated and helped to develop the trades in which they give instruction. Specific data, however, on this point are not procurable. As regards the industrial effects there are so many causes which directly or indirectly influence the development of an industry that no one can say to what extent it is due to the trade schools. He does not think that an industry can be developed or revived solely through the influence of trade schools. There must be a demand, an opening for the industry, and if it develops sufficiently schools will probably be founded to train the workmen, and this will accelerate the development of the industry. An industry which has grown rapidly in Geneva since the opening of trade schools is that of furniture making. The school for the building trades was founded so recently that its effects can hardly be seen as yet. Even now, however, it is noticed that a considerable output is being made of ornamental ironwork (locks, hinges, racks, etc.). This trade practically did not exist in the city before that school was established.

In the watchmaking school at Geneva the prescribed courses of training and study meet fully the views of its director. He states that the school supplies manufacturers of watches with educated workmen who can do useful work at once. A certain industrial development profitable to the locality results from these schools, although such schools are a result of the development of industries, and not the cause of their origin. This school has experienced no hostility from labor unions. On the contrary, they make a point of keeping informed about the pupils and examine graduates with regard to their efficiency. According to the views of this director, the men who have passed through this school, having received better and more general

instruction in their work, can advance more rapidly and reach a higher position than shop-trained men. After a few years of practical work they may become foremen. For the reasons stated above, employers prefer graduates of the school to merely shop-trained apprentices, while the ordinary shop training has been improved in consequence of the work of the school.

A graduate of the school, in entering on the practice of his trade, undergoes merely a formal apprenticeship which lasts only long enough for him to get accustomed to the methods of the shop.

ATTITUDE OF EMPLOYERS.

MACHINERY CONSTRUCTION.

The director of a machinery manufacturing company near Zurich, employing 46 foremen and 1,700 workmen and apprentices, stated that only in rare instances do its regular workmen attend a technical school after entering on the practice of their trade. The apprentices, numbering about 130, attend a continuation school in Oerlikon one half day per week, or in Zurich one day per week. The term of apprenticeship is four years, and during this period the apprentices are trained in a number of different occupations represented in the industry. The policy is to shorten the apprenticeship for those who adopt a special occupation. The apprentices are remunerated, and their attendance at the continuation school is strictly enforced.

The ages of the apprentices range between 14 and 20 years. The employees of the establishment have organized an association in which popular lectures are given on technical subjects.

The small number of regular workmen who do attend technical schools, go to the cantonal technical schools at Winterthur, Burgdorf, or Bienne, and their object is to fit themselves for higher positions. This company is of the opinion that the workmen trained in such schools obtain employment more easily (under certain conditions); that they command better positions and higher wages, and can more quickly rise to a high class of labor. The director also believes that the employment of such workmen has been of some advantage as regards the output of their establishment, and that the technical schools have produced a better-trained class of workmen.

SHOE MANUFACTURE.

A shoe manufacturer in Bern, employing 20 persons, of whom 2 have attended the Bern apprenticeship shops (*Lehrwerkstätten*), states that he favors the attendance on continuation schools by his employees during their apprenticeship period. He is of the opinion that workmen trained in trade schools secure better positions and higher wages than those not so trained, and that they can advance to a higher class of work; but he is not sure that they secure employment more

easily. His best workmen are, in point of age, the youngest, and owe their more rapid advancement solely to the instruction of the technical schools, which, he says, are of great advantage to the industry. It is, however, his belief that only such technical schools as provide an adequate workshop training will accomplish much.

WATCHMAKING.

A member of a prominent firm in Geneva, employing about 160 workmen and 8 foremen, states that nearly all the employees have gone through a school of watchmaking or of mechanics applied to this trade. There is in Geneva no evening school for workmen in this industry. As far as possible, the firm recruits its factory with graduates of the special trade schools for the reason that such men have a more extensive theoretical knowledge and are in better position than others to enlarge rapidly their practical knowledge. This firm believes that workmen so trained get employment more readily, obtain better positions and higher wages, and can rise sooner to a higher class. It regards the special trade schools as a necessity and thinks it a duty to facilitate in every way possible the entrance of young men into them.

ATTITUDE OF GRADUATES OF TRADE AND TECHNICAL SCHOOLS.

CUTTER, SHOE FACTORY.

A cutter employed in a shoe manufactory at Bern, was graduated from the shoemaking section of the apprenticeship shops in that city in 1893. He states that upon leaving the school he at once obtained a situation. He believes the school training has been advantageous to him, in proof of which he cites the grade of employment and wages he has been able to obtain. He thinks attendance on a technical trade school is the best way to learn a trade.

FOREMAN, MACHINE SHOP.

A foreman in the employ of a machine manufacturing company in Oerlikon, near Zurich, who attended the industrial school at Zurich one year and the technical school at Winterthur one term, states that he found immediate employment on leaving the latter institution in 1893. He says this technical training has been, in his opinion, of advantage to him. Besides enabling him readily to obtain employment, it has enabled him to obtain a better position and higher wages than he would otherwise have secured. He believes, however, that a practical apprenticeship in a machine shop is to be preferred as a method of learning the trade.

FOREMAN, SHOE FACTORY.

A foreman in the same factory, and a graduate of the same trade school in the same year, agrees at every point with the views expressed above.

MACHINE HANDS, WATCHMAKING.

Five hands employed in a watchmaking establishment at Geneva, who graduated from the Geneva Watchmaking School in different years between 1880 and 1898, all found employment immediately after leaving the school, and all agree that the technical training therein received was a help in securing a situation. Two of these men are of opinion that it also has enabled them to secure better positions and higher wages, while the other three do not credit it with such an effect. All five agree that a special trade school affords the most suitable method of learning a trade.

SETTER-UP, MACHINE SHOP.

A setter-up employed in the same machine shop, who had attended the technical school at Bienne, expressed the same views, except as to "better position and higher wages," which he had not yet experienced.

TECHNICAL EXPERT, MACHINE SHOP.

An expert in the assay office of this machine company, who graduated in 1897 from the technical school at Winterthur, expressed the same views as the foreman of a machine shop mentioned above.

ATTITUDE OF LABOR UNIONS.

The following statement was made by the head of the "Secrétariat Ouvrier" at Zurich: Trade and technical schools of the several types are regarded as valuable to the workingman. The trade unions here have always given such schools their moral support. At times they have organized and maintained small practical courses for workingmen (continuation schools) in localities not provided with State or communal trade schools. But this is becoming less frequent as new schools are established by the Government. These receive such liberal subsidies from the State and the communes that they do not need the financial support of the trade unions. The only union in this locality which limits the number of its apprentices is that of the printers. The unions require three years' apprenticeship. No union requires a shorter apprenticeship for graduates of industrial schools than for other apprentices. The only way they can get practical experience in their work is by going through the same apprenticeship as the others. But at the end of that term graduates are much better prepared for their trade than those who learn the trade solely by the apprenticeship system, because of the theoretical knowledge and systematic training which they obtain in the schools. The engravers' union is an exception, for it admits no one who has not been through the school and allows no apprenticeship. He would send his boy to a trade school if he was to be prepared for a trade, for the reason that he would learn his trade more thoroughly and have a better chance of securing a good situation.

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